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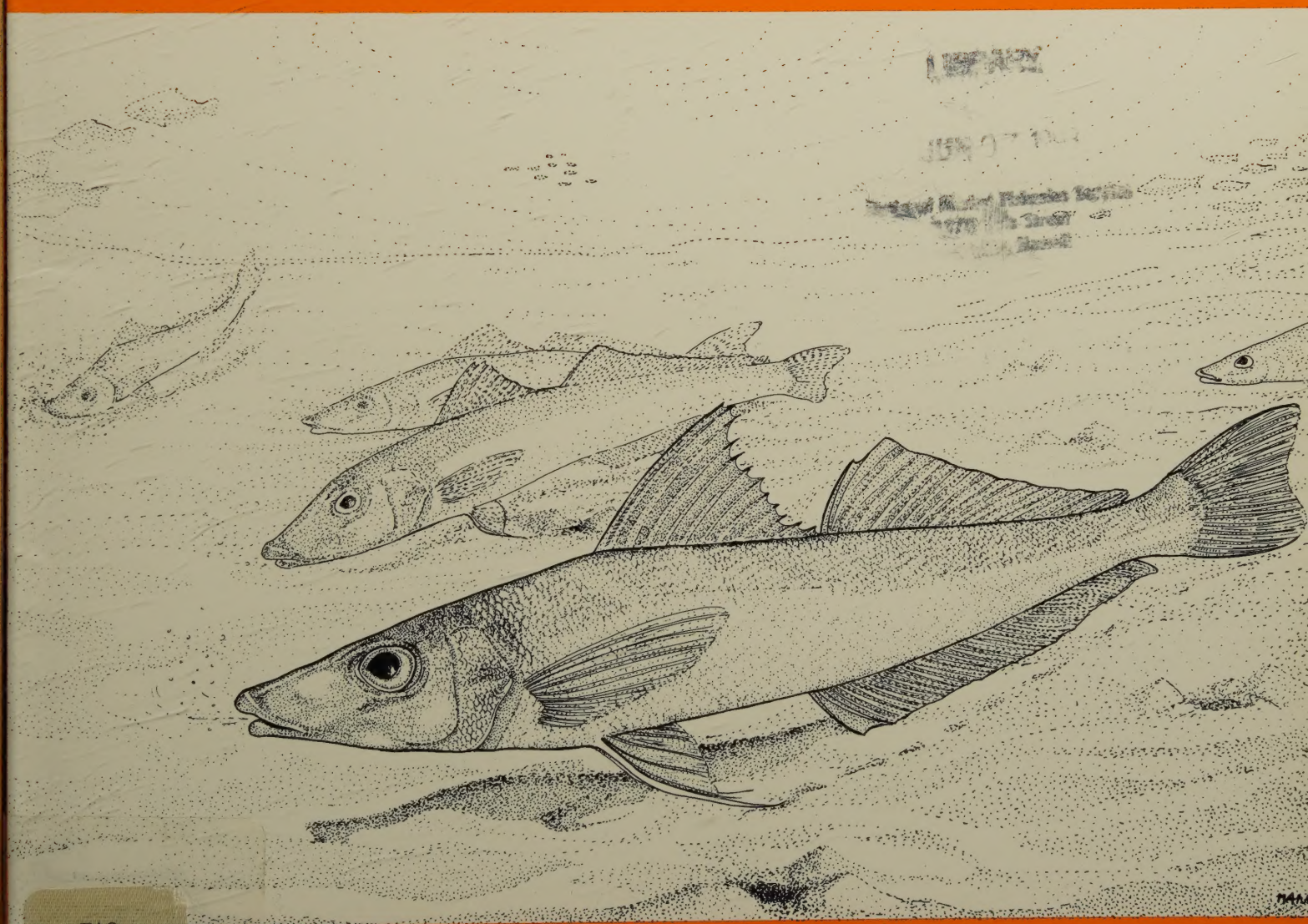
FAO SPECIES CATALOGUE

VOL. 14 SILLAGINID FISHES OF THE WORLD

(Family Sillaginidae)

An Annotated and Illustrated Catalogue of the Sillago, Smelt or Indo-Pacific Whiting Species Known to Date



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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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of the Sillago, Smelt or Indo-Pacific Whiting Species

Known to Date

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PREPARATION OF THIS DOCUMENT

This document was prepared under the FAO Fisheries Department Regular Programme in the Marine Resources Service of the Fishery Resources and Enivornment Division. It is the fourteenth worldwide species catalogue in the FAO Fisheries Synopsis series.

The author is the foremost specialist in sillaginid taxonomy; his early recognition of the importance of the swimbladder morphology assisted other workers to review the sillaginids of their region. He has published several papers on sillaginids, including a revision of the family and papers describing nine new species. His work on sillaginids is based on an extensive review of the literature, the examination of type and other preserved specimens from the major museum of the world, and the examination of fresh material from many locations throughout the Indo-Pacific region.

The illustrations were either drawn by the author or were redrawn (and modified) at FAO from the literature or from the author's sketches under the supervision of the editors.

English FAO fish names were established in consultation with J.S. Nelson, University of Alberta, Edmonton (Chairman, committee on Common Names of Fishes, American Fisheries Society and Amerrican Society of Ichthyologists and Herpetologists). Official French names were created in consultation with J.-C. Quero, Institut Français pour l'Exploitation de la Mer, l'Houmeau and T. DoChi, FAO. Spanish FAO names were adapted from the literature or translated from the English FAO names with help of D. Die, FAO.

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ABSTRACT

This is the fourteenth issue in the FAO series of world-wide annotated and illustrated catalogues of the groups of marine organisms that enter marine fisheries. The present volume on the family Sillaginidae includes 31 species in 3 genera and 3 subgenera. Three species, formerly recognized as subspecies, are herein recognized as distinct species, one of them for the first time. This volume includes an introductory section with general remarks on habitat, biology, fisheries, systematics, zoogeography and problems of identification, a glossary of technical terms, illustrated keys to genera and species, including regional keys, detailed accounts of species, and a table of species by major fishing area. Species accounts include illustrations, scientific and vernacular names, references to scientific names, information on habitat, biology and fisheries, and a distribution map. The work is fully indexed and there is an extensive reference to pertinent literature.

Distribution

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I owe a great debt to Dr Walter Fischer (FAO, Rome) in initiating this catalogue series which is now recognised as one of the most important programmes for the publication of worldwide taxonomic revisions of marine organisms. My debt also includes that of his long personal encouragement, friendship, advice and concern during a trying period in the compilation of this catalogue. When my sight was impaired Walter was particularly supportive. For this, and innumerable other occasions whilst engaged in the Expert Consultants Programme, Cochin, India, I am greatly appreciative. I wish Walter Fischer a happy retirement.

To Dr Marie-Louise Bauchot of the Muséum national d'Histoire naturelle (MNHN), Paris my sincere thanks for her long encouragement and assistance with the study of the type species of the families Sillaginidae and Haemulidae under her care. I wish her a happy and fruitful retirement. The studies undertaken by Dr Bauchot and co-workers established a secure systematic foundation for catalogues of this kind. It should be recognised that a large number of colleagues assisted in the preparation of the revision of the Sillaginidae by McKay (1985); their assistance, although acknowledged in that work, is again appreciated in providing the basis for this catalogue. Help with the fishery statistics was kindly provided by Dr. P. Kailola. Finally, the corrections to the manuscript, the layout of the text and illustrations were undertaken by FAO staff including K.E. Carpenter, C. Sommer and P. Lastrico.

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1. INTRODUCTION

This catalogue includes taxonomic references to all the known species of the family Sillaginidae. At present, 3 genera, 3 subgenera and 31 species are recognised (Fig. 1). The taxonomy of this family is approaching stability with perhaps only a few undescribed species remaining (McKay, 1985; 1989). The family is widespread throughout the Indian Ocean and the western Pacific Ocean. All species are inshore fishes with a few species found in deeper water to about 180 m. They are commonly taken by net and hook-and-line in shallow sandy bays and frequently enter estuaries. All sillaginids are of small to moderate size and their flesh is very white, tender, and of exceedingly delicate flavour, making them esteemed table fish throughout their range. Steamed whiting fillets are ideal as food for invalids and infants because they contain very little oil and are easily digested.

The family is well represented in Australian waters and supports valuable commercial fisheries in many countries (Table 1). Their importance as food fish is perhaps underestimated because in many areas they are taken by small-scale fishermen using seine net and hook-and-line in large quantities and do not necessarily enter records of commercial catches. In Australia the "whitings" are among the most common beach and estuarine fishes caught by recreational fishermen who, although hoping to land large sport or food fish, instead are often rewarded for their efforts by a bag of sillago.

Sillaginids are easily identified as a family due to their similarity of shape and general uniformity of coloration. They have an elongate body, a long conical snout, a long soft dorsal and anal fin, and the lower part of the preopercle is horizontal. This external morphological similarity however, has led

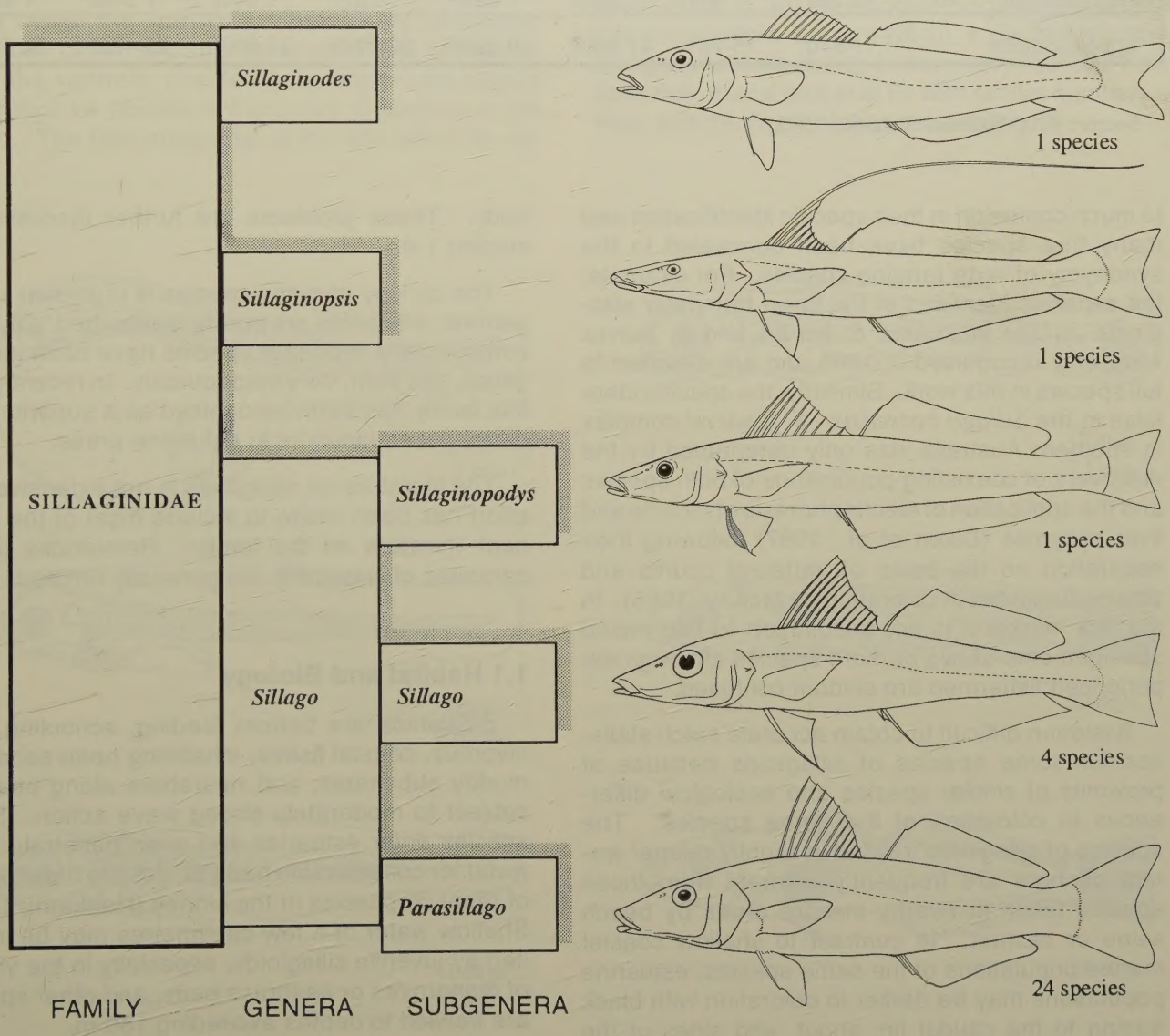


Fig. 1 Classification of the family Sillaginidae

Table 1
Sillaginid catches in world fisheries in metric tons (F = FAO estimates)

COUNTRY	FAO Area	year							
		1983	1984	1985	1986	1987	1988	1989	1990
Pakistan	51	486	624	228	312	350	310	290	280
W. Australia	57	1 991	1 965	2 071F	2 918F	3 725F	3 909F	3 267F	4 156F
Malaysia	57	573	448	353	386	386F	386F	390F	390F
Thailand	57	247	293	884	1 006	846	1 048	1 000F	960F
Korea	61	998	289	160	709	103	160	141F	140F
N.E. Australia	71	1	-	-	-	-	-	-	-
Malaysia	71	448	566	474	440	440F	440F	440F	440F
Philippines	71	10 091	8 354	9 600	9 866	12 178	9 729	10 326	10 478
Singapore	71	84	106	107	116	95	137	107	128
Thailand	71	1 386	2 205	3 063	3 123	3 373	3 678	4 000	3 820F
S.E. Australia	81	1 265	911	960F	1 353F	1 727F	1 812F	1 514F	1 926F
Species total		17 570	15 761	17 900F	20 229F	23 223F	21 609F	21 475F	22 718F

Source: FAO Fisheries Statistics, 1992.

to much confusion in their specific identification and many true species have been concealed in the synonymy of wide ranging species. For example, the separate identities of the three trumpeter sillaginids *Sillago maculata, S. aeolus* and *S. burrus* were only recognised in 1985 and are elevated to full species in this work. Similarly, the specific identities in the *Sillago bassensis - S. flindersi* complex in southern Australia was only determined by the discovery of coexisting populations of both species and the application of electrophoresis of muscle and liver enzymes (Dixon et al., 1987) following their separation on the basis of vertebral counts and small differences in coloration by McKay (1985). In the fish market it is not uncommon to find mixed consignments of two or more species although experienced fishermen are seldom confused.

It is often difficult to obtain accurate catch statistics for some species of sillaginids because of proximity of similar species and ecological differences in coloration of the same species. The species of sillaginids trawled in slightly deeper waters offshore are frequently different from those species taken in nearby inshore areas by beach seine or castnet. In contrast to shallow coastal marine populations of the same species, estuarine populations may be darker in coloration with black edging to the caudal fin, snout, and sides of the body. These problems are further discussed in section 1.4.

The biology of many species is unknown and in general, sillaginids are poorly researched. Only the commercially important species have been investigated, and then, very inadequately. In recent years this family has been recognised as a superior candidate for aquaculture in estuarine areas.

The literature on sillaginids is not extensive. An effort has been made to include most of the pertinent literature on the family. References to the parasites of sillaginids are generally omitted.

1.1 Habitat and Biology

Sillaginids are bottom feeding, schooling, carnivorous, coastal fishes, inhabiting open sandflats, muddy substrates, and nearshore along beaches subject to moderately strong wave action. Some species enter estuaries and even penetrate fresh water for considerable periods, despite the absence of renal corpuscles in the kidney (Nadkarni, 1963). Shallow water of a few centimetres may be inhabited by juvenile sillaginids, especially in the vicinity of mangroves or seagrass beds, and other species are trawled to depths exceeding 180 m.

The sharp snout of sillaginids facilitates burrowing in the sand in search of worms, crustaceans, and small molluscs. In muddy substrates sillago drive the snout deep into the bottom to feed on worms. The feeding grounds may be identified in shallow water due to the conical depressions left in the surface. *Sillago analis* has been observed to plough up the substrate in search of prey. Food items commonly reported for sillaginids are benthic and epibenthic organisms, principally polychaete worms, small shrimps, amphipods, small crabs, fish and filamentous algae.

These fishes are capable of burrowing completely into the sand to escape predators or to dodge the seine net. Fishermen sometimes walk behind the hauled seine to feel with their bare feet for sillaginids buried under the sand after the leadline of the net has passed; for this reason they are frequently called sandborers.

The greatly expanded sensory system of the lower part of the head and the swollen sides of the snout are apparently employed in the location of prey below the substrate. This highly developed sensory canal system, particularly the lachrymal and the ventrally directed subpreopercular canals may receive vibrations from prey organisms in the sand. The filamentous tip of the first pelvic-fin ray which many species maintain in contact with the substrate, is an additional potential sensory receptor. In *Sillago chondropus*, this filament has been modified to form a sled-like runner. The curious tubular extension from the lower part of the swimbladder to the ventral wall of the abdomen may also function as a receptor for sound or vibration, conveying stimuli to the swimbladder in the manner of an external ear. The complex swimbladder undoubtedly receives sound and transmits this to the auditory capsules in a number of species having anterior extensions from the swimbladder to the skull. The function of the lateral extensions and the post abdominal extensions of the swimbladder in some *Sillago* species has not been determined. This family does not have sonific (drumming) muscles associated with the swimbladder and therefore this organ is unlikely to produce sound as in the related family Sciaenidae.

According to Leis and Trnski (1989) the eggs of sillaginids are small (0.6 to 0.8 mm), spherical and pelagic. The larvae can be distinguished by a myomere count of 33 to 39, an elongate body, a gas bladder that is not visible during daylight, a gut that is initially straight and coils during flexion, very reduced head spination, dorsal and anal fin with similar numbers of rays, and the pigmentation pattern (Fig. 2).

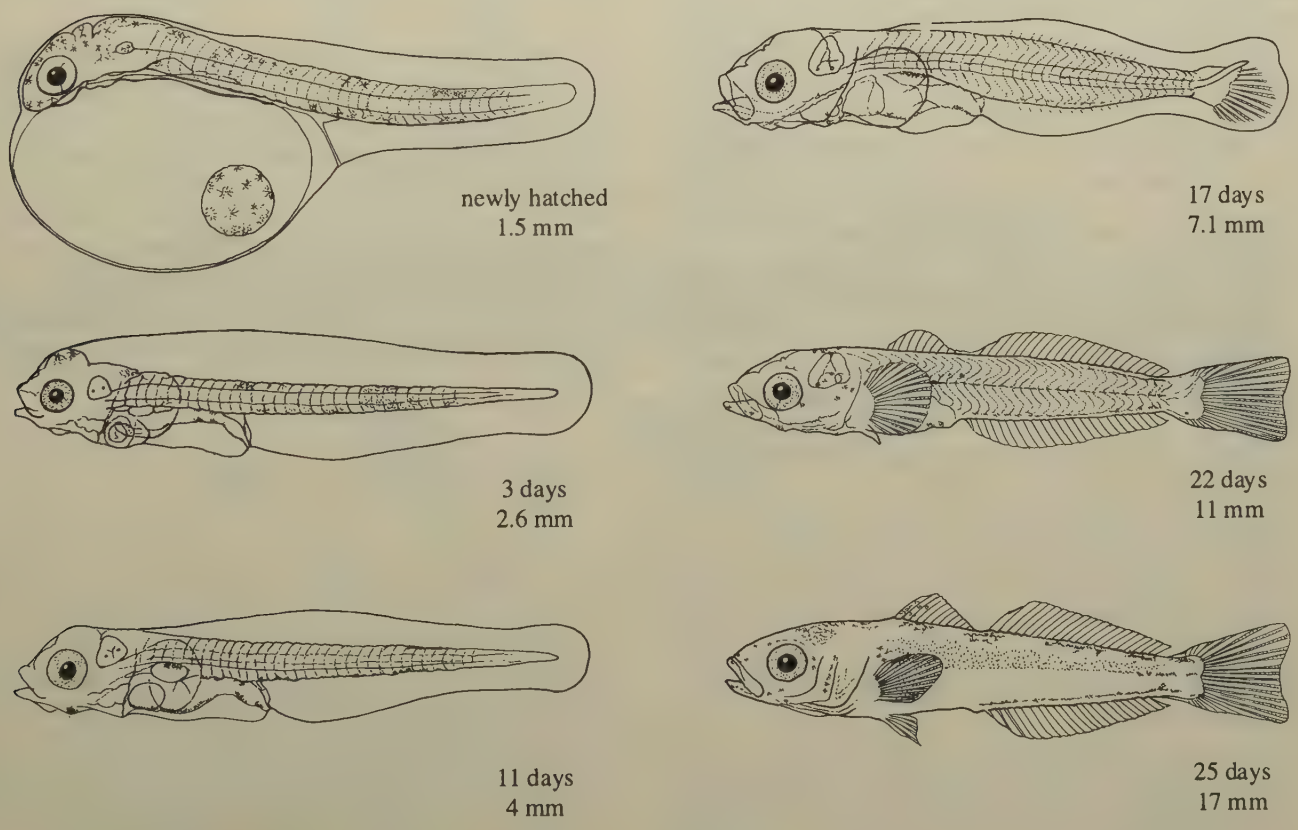


Fig. 2 Larval development of *Sillago japonica* (after Oozeki et al., 1992)

1.2 Fisheries

Small but locally important fisheries exist throughout the range of the family. Sillagos are benthic fishes and are fished on the bottom. The fishes generally inhabit inshore coastal waters and are mostly taken by beach seines. In deeper water, trawlers take considerable quantities using beam trawl and otter trawl nets. As all species consume a variety of food items, many sillaginids are taken by line baited with worm, shrimp, and fish. Some of the most popular baits are soldier-crabs (*Mictyris*), worms and yabbies (*Callianassa*). Some species are taken by line in the surf zone and in remarkably shallow water over sandflats and in the sandy channels of estuaries. Some marine species, such as *Sillago sihama*, enter fresh water (Günther, 1861: 221) and may remain in the estuary for considerable periods.

Large schools of sillago are observed feeding in shallow water early in the morning and late afternoon, usually working against the tide. In the middle of the day they may move into deeper water and are not as readily taken by line. Experienced fishermen take care not to make undue noise on the beach or in the boat as the fish are regarded as sensitive to noise and in some small estuaries are disturbed by outboard motors to the extent that schools may avoid entering such areas. The fish are also sensitive to movement, especially shadows; castnet fishermen employ the tactic of paddling into the sun toward a school and drifting slowly upon it before casting the net. Estuarine castnet fishermen frequently work in pairs or trios, all casting at the same time or one after another in quick succession.

Sillaginids are sought after by recreational fishermen who take considerable quantities in Australian waters. Pollock (1980) estimated the annual catch by net fishermen in southeast Queensland during the 1980-81 season at 240 t. He estimated that recreational anglers caught 25 t of *Sillago ciliata* at nearby Bribie Island in the same season. Catches by angling club members at the latter location has decreased due to heavy fishing pressure, but the recreational catch in Moreton Bay shows no change in abundance (Pollock and Williams, 1983). Catches from commercial fisheries are reported from 7 countries (Table 1). During the period 1983 to 1990 overall catch was relatively stable with moderate increases reported in Australia and Thailand.

Sillaginids are important in estuarine aquaculture in India, Japan and Taiwan (China). Their potential for aquaculture in Australia has been recognised and research is under way on *Sillago ciliata* and *Sillaginodes punctata.*

1.3 Systematics and Zoogeography

The Sillaginidae are related to the family Percidae, but their sister group is yet to be determined as this family possesses a number of primitive characters. The shared derived characters (synapomorphies) of the Sillaginidae are the swimbladder duct to the ventral abdominal wall, the haemal funnel, the lower part of the preopercle is bent inward, and the highly cavernous skull. The otolith morphology is characteristic of the family. See McKay (1985) for further information regarding the systematic affinities of the Sillaginidae.

The most plesiomorphic genera of the family are the monotypic *Sillaginodes* and *Sillaginopsis* which lack the duct from the ventral surface of the swimbladder. The genus *Sillaginodes* is perhaps the most plesiomorphic, whereas *Sillaginopsis* and to a lesser extent *Sillago (Sillaginopodys) chondropus* are specialized bottom resting species that have the swimbladder reduced or even absent.

All are inshore species frequenting the sandy or silty substrates of the continental shelves of the Indo-Pacific region. The oceanic islands of the Pacific, including Fiji, Tonga and Samoa lack sillaginids. The family is found in New Caledonia and to Santa Cruz Island, but not southward to New Zealand where they are represented as fossils in Eocene and Lower Miocene deposits (Schwarzhans, 1984, otoliths only).

The origin of the Sillaginidae was probably in the Tethys Seaway during the Lower Eocene. During the Upper Eocene a shallow sea-way broke through south of Tasmania and this family colonized southern Australia. During the Miocene many Indo-Pacific sillaginids had become endemics (Schwarzhans, 1984). Fossil otoliths are known from Germany and France from the Upper Oligocene to the Lower Miocene. The family became extinct in New Zealand, probably during the Middle Miocene.

1.4 Problems of Identification

The identity of the species in this family has been considerably confused in the literature. The main reason for this problem is the great similarity in shape and coloration among the species. Many species are of uniform colour or external morphology. The juvenile coloration of *Sillago ciliata* and *S. analis* resemble the juveniles and adults of *S. maculata* in having a series of dark blotches and bars on the body. This juvenile coloration persists until the fish reach 10 cm, but in some specimens of *S. analis* it may still be discernible at 20 cm, or appear briefly on capture. The characteristic black spot at the

base of the pectoral fin in *S. ciliata* and *S. maculata* may not appear until a standard length of about 5 cm is attained. Juvenile *S. maculata* can be distinguished from those of *S. ciliata* in having clearly defined dark round blotches anteriorly. A key to the juveniles of *S. maculata, S. ciliata* and *S. analis* is provided by Weng (1983). Another source of confusion is the possession of a very similar colour pattern by quite distinct species. This led to the inclusion of *S. burrus* and *S. aeolus* in the synonymy of *S. maculata* and confusion between *S. bassensis* and *S. flindersi*.

The resolution of such species groups was possible only when the shape of the swimbladder and the division of the vertebrae into abdominal, modified (haemal arch) and caudal components was taken into account (McKay, 1985). The field identification of sillago remains difficult. Where vertebrae counts are required it is possible to place fresh or frozen sillaginids into cold water and bring the fish to a gentle boil and then cool quickly with cold water and deflesh carefully. The vertebral column can be kept intact (with a little practice) and air dried for storage or preserved in alcohol. The shape of the swimbladder can be studied in fresh specimens, but is more readily dissected after fixation in formalin or exposure to undiluted alcohol for several days. Specimens are dissected by a cut down the ventral surface from the isthmus to a few millimetres before the vent, thence circumventing the anus and urogenital aperture and cutting along the base of the anal fin to the vertebral column to expose the full length of the swimbladder; the gills and viscera are removed and the thin peritoneum covering the swimbladder is pulled away with blunt forceps. Care should be taken not to damage any anterior or lateral appendages nor break the tubular process arising from the ventral surface of the swimbladder to the abdominal wall near the urogenital aperture. This tubular, blind, duct-like process is not connected to the gut (Fig. 3).

In addition to the key to the genus *Sillago*, which should be used for all specimens where locality of capture is unknown or doubtful (market material), area keys are provided to facilitate identification. **The area keys may contain species not yet recorded from the area.** All identifications made from the illustrated keys should be confirmed by consulting the diagnoses in the species accounts. Full descriptions of all species can be obtained by consulting the references cited in the literature provided for each species. Unfortunately, most of the earlier publications containing accounts of the family Silliaginidae are unreliable. In many instances the type specimens were not examined and valid species were incorrectly placed into synonymy based on inadequate descriptions. Misidentifications abound in the literature due to the neglect of useful internal characters.

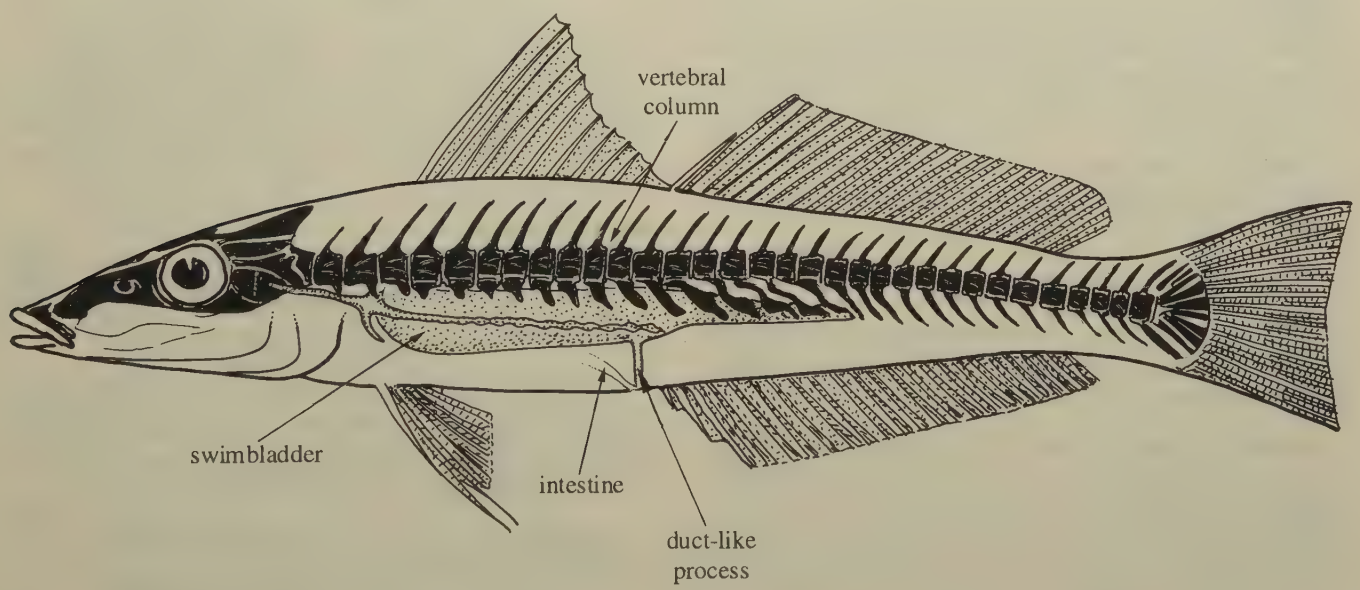


Fig. 3 Swimbladder in relation to the vertebral column

1.5 Illustrated Glossary of Technical Terms, Measurements and Counts

A typical sillago is shown in Fig. 4. Note that the snout and head measurements are taken from the tip of the snout and not the upper lip which is frequently depressed or sometimes protracted in alcohol preserved specimens.

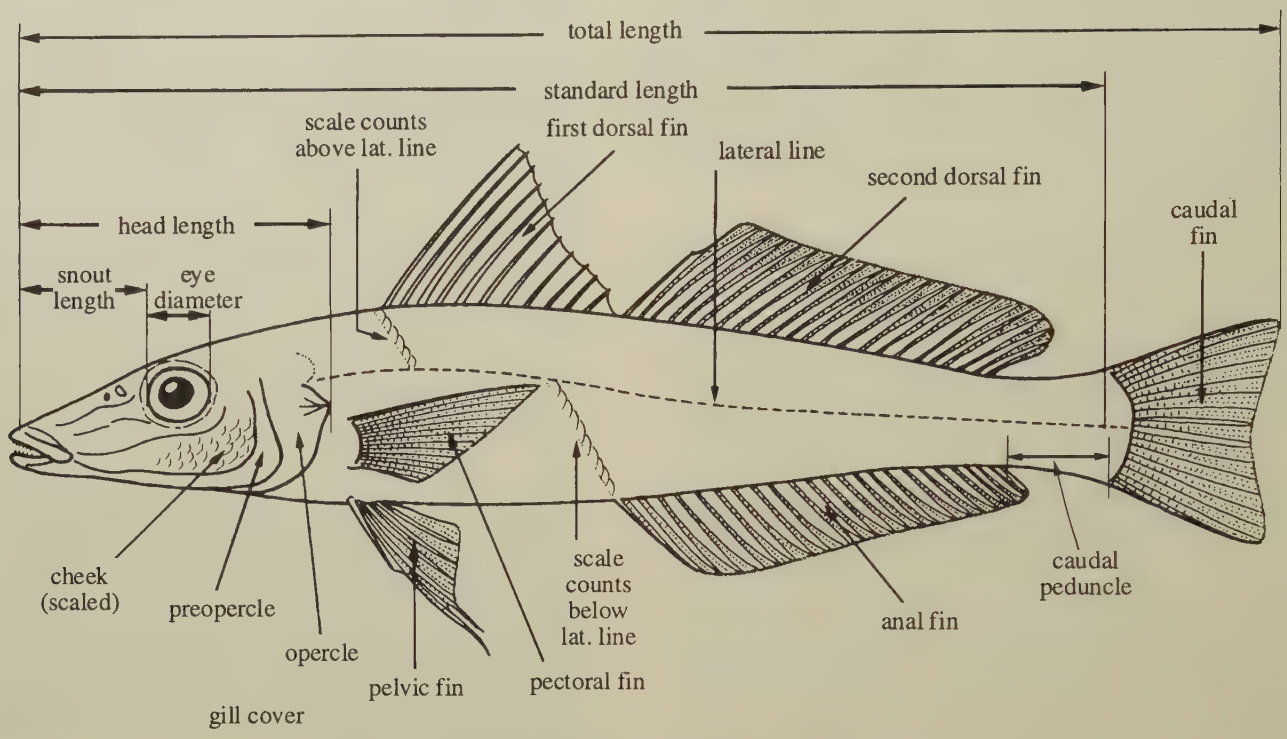


Fig. 4 External morphology and measurements

Anterior - The front portion; the opposite of posterior.

Anus - External opening of the intestine, situated on the ventral midline of the body (Fig. 4). Also known as vent.

Bar - An elongate colour marking with vertical orientation, the sides of which are usually more or less straight.

Blotch - A pigmentation, irregular in shape.

Caudal peduncle - The narrow end of the body between the posterior basal end of the anal-fin base and to the base of the caudal fin (Fig. 4).

Cheek, cheek scales - The area between the lower part of the eye and the lower limb of the preopercle. The scale rows may consist of ctenoid, cycloid, or both kinds of scales, frequently the cycloid scales are above and anterior to the ctenoid scales if both are present (Fig. 4).

Ctenoid scales - Scales with small spiny projections at the posterior end (Fig. 5a).

Cycloid scales - Scales without spiny projections at the posterior end (Fig. 5b).

Dorsal - Toward the back or upper part of the body.

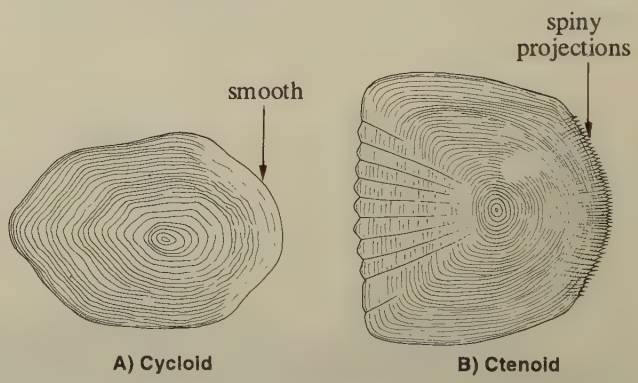


Fig. 5 Scales

Dorsal fin - A median fin along the back. Sillaginidae have two dorsal fins; the first is supported by spinous rays while the second has one spinous anteriorly and soft rays posteriorly (Fig. 4).

Eye diameter - The diameter between the fleshy margins of the orbit (Fig. 4).

Gill arch - The J-shaped structure under the gill cover that bears the gill filaments and normally the gill rakers.

Head length - The distance from the most distant end of the opercle to the snout and not the upper lip which is frequently depressed or sometimes protracted in alcohol preserved specimens (Fig. 4).

Hyaline - Transparent.

Lateral line - A series of pored or tubed scales forming a raised line along the side of the body (Fig. 4). The **lateral-line scales** are counted from the most anterior pored scale near the upper end of the operculum to the base of the caudal fin which is detected by the crease which results from folding the fin forward. There are often one or more tubed scales that continue onto the caudal fin, posterior to the base of the caudal fin; these are not included in the count of lateral-line scales.

Medial - Toward the middle or median plane of the body; opposite of lateral line.

Opercle - The large bone forming the upper posterior part of the **gill cover** (Fig. 4).

Orbit - The bony border surrounding the eye. Measurements or distances which involve the orbit do not include the fleshy rim of the orbit. It is sometimes necessary to slightly squeeze the rim of the orbit to exclude this fleshy portion.

Pectoral fin - The fin on each side of the body immediately behind the gill opening (Fig. 4).

Pelvic fin - One of a pair of juxtaposed fins ventrally on the body below the pectoral fins (Fig. 4).

Posterior - The rear or hind portion; the opposite of anterior.

Preopercle - Bone on the cheek in front of the opercle and forming the front part of the **gill cover** (Fig. 4).

Rays - The rigid structures that support the fin; **soft rays** are segmented, and flexible; **spinous rays** are stiff, unsegmented, and support the anterior portion of the anal and dorsal fins. The number of spines are designated by roman numerals (I, II, III, IV, V ...) and the number of soft rays are designated by arabic numerals (1, 2, 3, 4, 5 ...). In the Sillaginidae, the last dorsal- and anal-fin pterygiophore supports two rays that are counted as a single element in this work. The anal spines are invariably two in number, the first is often quite small.

Scales above and below lateral line - A transverse series of scale rows; scales below lateral line are counted from the origin of the anal fin in an oblique row to the lateral-line scale, but not including the lateral-line row; scales above the lateral line are counted from the origin of the dorsal fin in an oblique row to the lateral-line scale, but not including the lateral-line row (Fig. 4).

Snout length - The distance from the anterior "fleshy" margin of the eye to the snout (Fig. 4) and not to the upper lip which is frequently depressed or sometimes protracted in alcohol preserved specimen.

Spot - A small, rounded regular pigmentation.

Stripe - An elongate colour marking with a horizontal or length-wise orientation, the sides of which are more or less straight.

Standard length - The straight line distance from the tip of the snout to a vertical line passing through the base of the caudal fin (taken to be the point of flexure of the caudal fin) (Fig. 4).

Swimbladder - A gas filled sac in the dorsal part of the body cavity. In Sillaginidae the swimbladder is important in classifying many forms and the swimbladder may be absent, poorly developed, or highly complex with various extensions (Figs 3, 6).

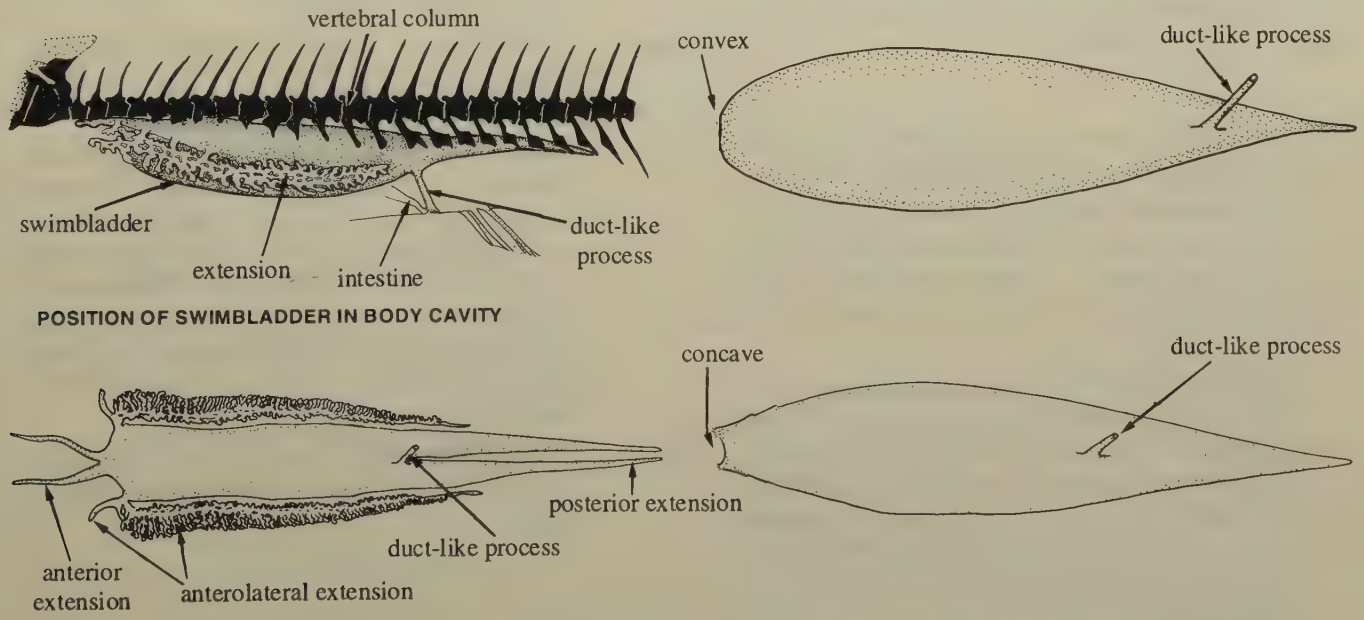


Fig. 6 Swimbladders

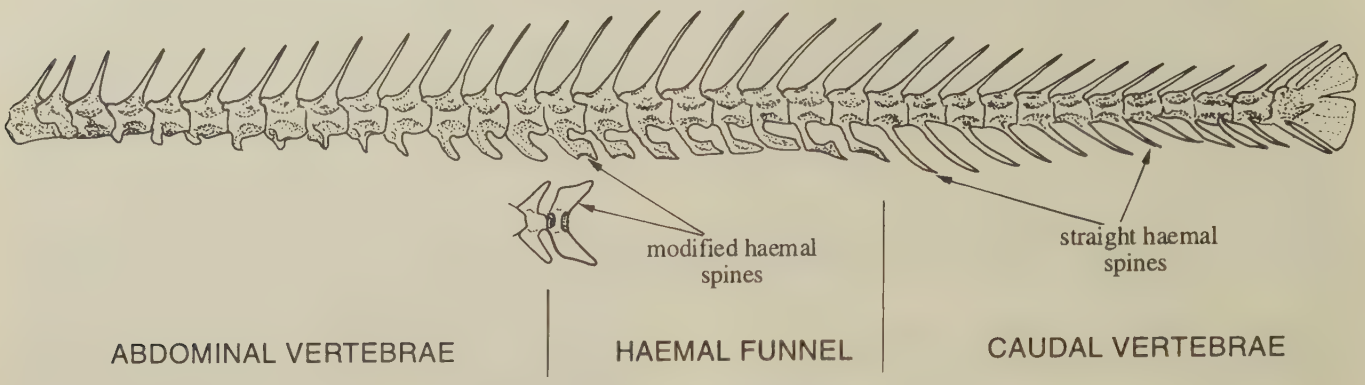


Fig. 7 Axial skeleton of *Sillago*

Ventral - Toward the lower part of the body; the opposite of dorsal.

Vertebrae - The axial skeleton is divided into 3 sections; the **abdominal vertebrae** are counted from the base of the skull to the first haemal arch (the arch that appears as a canal under the circular centrum and is formed above the fused proximal ends of the haemal spines of caudal vertebrae); the **modified vertebrae** overlay the swimbladder (**haemal funnel** or **haemal vertebrae**); the **caudal vertebrae** bear a **haemal spine** (the spines that extend ventrally from the centrum of a caudal vertebrae) ventral to the vertebral centrum (urostylar vertebrae included) (Fig. 7).

1.6 Plan of the Systematic Catalogue

A family description is given, followed by a key to genera. The species accounts are arranged alphabetically by genera and species. Each genus is introduced with its type reference and synonyms. The information pertaining to each species is arranged in the order listed below:

(1) **Scientific Name:** The reference for the original description and type locality is given.

(2) **Synonyms:** All invalid names, combinations and misidentifications that have been applied are referenced. References are provided here since the bibliography of this family is not extensive.

(3) **FAO Names:** The FAO English name is considered the standard to be used for fishery purposes. This should avoid confusion which can be caused due to the existence of multiple names for the same species or the same name for several species. The FAO name is not intended to supplant the use of local names but rather, to serve as a worldwide reference.

(4) **Diagnostic Features:** Distinctive characters of the species are given as an aid for identification, accompanied by useful diagrams. These diagnoses should be consulted to confirm species identified using the illustrated keys.

(5) **Geographical Distribution:** The general geographic range is given in the text and illustrated on a map. The map shading includes known areas of occurrence and intermediate areas between locality records where a species is expected to be found.

(6) **Habitat and Biology:** Information on habitat, behaviour, food, feeding habits and reproduction is given.

(7) **Size:** The maximum known total length or standard length is given.

(8) **Interest to Fisheries:** General information on the extent, type of fishery and utilization is given. Detailed fisheries data are unavailable for many species as species are rarely separated in fishery statistics.

(9) **Local Names:** These are given where published names are available. Often, a single local name is applied to several species.

(10) **Literature:** Recent references containing illustrations that supplement those contained in this catalogue are given. The most important references containing full bibliographies and descriptions are provided. It is stated if an incorrect name is given in the reference. Where incorrect scientific names are commonly applied a more comprehensive bibliography is given.

(11) **Remarks:** Useful information that is not covered in the previous paragraphs is included here.

2. SYSTEMATIC CATALOGUE

2.1 Diagnostic Features of the Family SILLAGINIDAE

FAO Names: **En** - Sillagos, Sand Smelts and Whitings; **Fr** - Sillaginidés; **Sp** - Sillagínidos.

Diagnostic Features: Elongate, only slightly compressed, head tapering, with terminal mouth; lower part of the cheek separated by a deep channel and bent inward to almost meet that of the other side. Body covered with small or moderate sized ctenoid scales, those of the cheek cycloid or ctenoid; lateral-line scales 50 to 141, with simple pores and continuing on to the tail. Mouth with a band of brush-like teeth; with canine teeth in the upper jaw in ***Sillaginopsis*** only; vomer with a small curved patch of teeth, none on palatine bones on roof of mouth; upper jaw covered by a large lachrymal or preorbital bone bearing a raised dome that greatly enlarges the sensory system of the snout region; lower jaw with a pair of small pores behind which is a median pit containing a pore on each side; operculum with a short sharp spine; head elongate, with a greatly developed sensory canal system above and laterally, and the entire ventral surface of the head is occupied by the lower preopercular sensory system. This development of the cranial sensory system is characteristic of the family; the otolith is large and the base of the skull is enlarged, suggesting the reception of sound is important. Two dorsal fins, the first consisting of X to XIII slender spines, the second long with I slender leading spine and 16 to 27 soft rays; anal fin long with II small slender spines and 14 to 26 soft rays; caudal fin emarginate; unpaired fins with the membranes scaly; pelvic fins with I spine and 5 rays, the first ray usually with one or two small projecting filaments that are often in contact with the bottom as the fish swims in search of food, and in ***Sillaginopodys***, the first ray is thickened and used as a sled to maintain contact with the substrate. The swimbladder is either absent, poorly developed, or highly complex with anterior and lateral extensions that project well into the caudal region; a unique duct-like process from the ventral surface of the swimbladder to just before the urogenital opening is present in most species. The vertebrae are modified where they contact the posterior extension of the swimbladder in many species; the vertebrae number 32 to 44; the vertebral number, divided into abdominal, modified or haemal, and caudal categories is useful for identification of some species (Table 2).

2.2 Illustrated Key to Genera and Species

2.2.1 Key to Genera

1a. Snout and head depressed; second dorsal-fin spine elongate; eyes small and almost covered by skin; swimbladder minute or absent (Fig. 8) . . . . . ***Sillaginopsis***

1b. Snout and head not depressed; second dorsal-fin spine not elongate; eyes normal; swimbladder present . . . . . → *2*

Fig. 8 ***Sillaginopsis***

2a. Lateral-line scales 50 to 84 (Fig. 9) . . . . . ***Sillago***

2b. Lateral-line scales 129 to 147 (Fig. 10) . . . . . ***Sillaginodes***

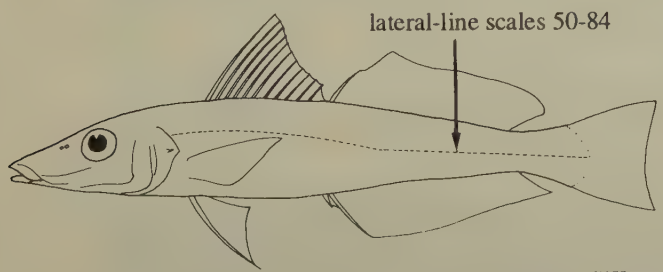


Fig. 9 ***Sillago***

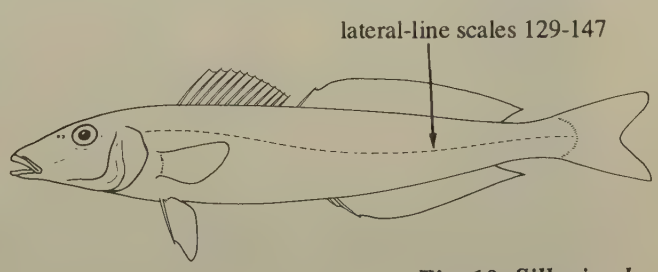


Fig. 10 ***Sillaginodes***

Table 2: **Frequency distribution of abdominal and caudal vertebrae for species of the family Sillaginidae**

	Vertebrae Numbers																															
Abdominal	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	15	15	16	16	16	16	17	20	21	21	21	22	22	23
Caudal	21	22	23	19	20	21	22	25	18	19	20	21	22	18	19	20	22	23	25	27	21	22	23	24	20	23	21	22	23	21	22	21
S. aeolus						4					26																					
S. analis					1					81	2																					
S. arabica																		1	1			1	18									
S. asiatica						1					34																					
S. attenuata																	1															
S. bassensis	1	3			1	79	4				3																					
S. boutani								1																								
S. burrus							2				5	99	3																			
S. chondropus			4				8																									
S. ciliata					1				3	167	1			3	2																	
S. flindersi				2	128	7																										
S. ingenuua					7	1																										
S. intermedius											1																					
S. japonica												16																				
S. lutea					8	310	13																									
S. macrolepis											1																					
S. maculata						2	7				1	139	11			4																
S. microps						2																										
S. panijus																				1												
S. parvisquamis																										1	2	16	11	23	30	1
S. punctata																							3	1								
S. robusta					66																				2							
S. schomburgkii																					72											
S. sihama											225																					
S. vincenti											18	1																				
S. vittata				1	23	1																										

2.2.2 Key to the Genera and Species from the Indo-west Pacific Region Excluding Australia and New Guinea

1a. Snout and head greatly depressed; second dorsal-fin spine very elongate; eyes small, 3 to 11% of head length, and almost covered by adipose tissue (Fig. 11); swimbladder vestigial or absent . . . . . ***Sillaginopsis panijus***

1b. Snout and head not depressed; second dorsal-fin spine not elongate; eyes normal, 17 to 30% of head length; swimbladder present (Fig. 12) . . . . . ***(Sillago)*** → ***2***

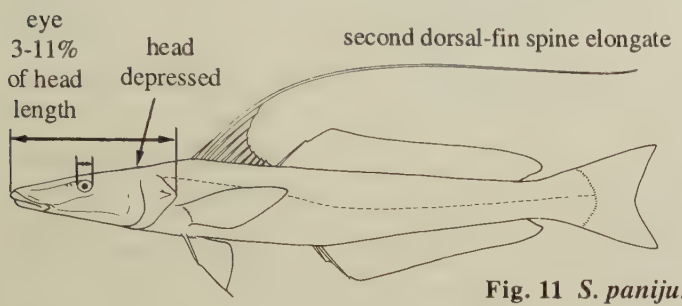


Fig. 11 ***S. panijus***

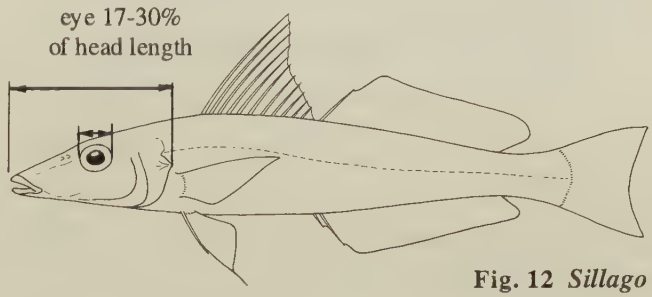


Fig. 12 ***Sillago***

2a. Pelvic fin with the spine inconspicuous and almost hidden by the much thickened club-like first pelvic-fin ray (Fig. 13); swimbladder without postcoelomic projections into the tail section; vertebral column without modified haemal spines overlying the posterior extensions of the swimbladder (no haemal funnel) . . . . . ***Sillago chondropus***

2b. Pelvic fin without a thickened club-like first ray; swimbladder with 1 or 2 postcoelomic extensions; vertebral column with some modified haemal spines overlying the posterior part of the swimbladder (haemal funnel present) . . . . . → ***3***

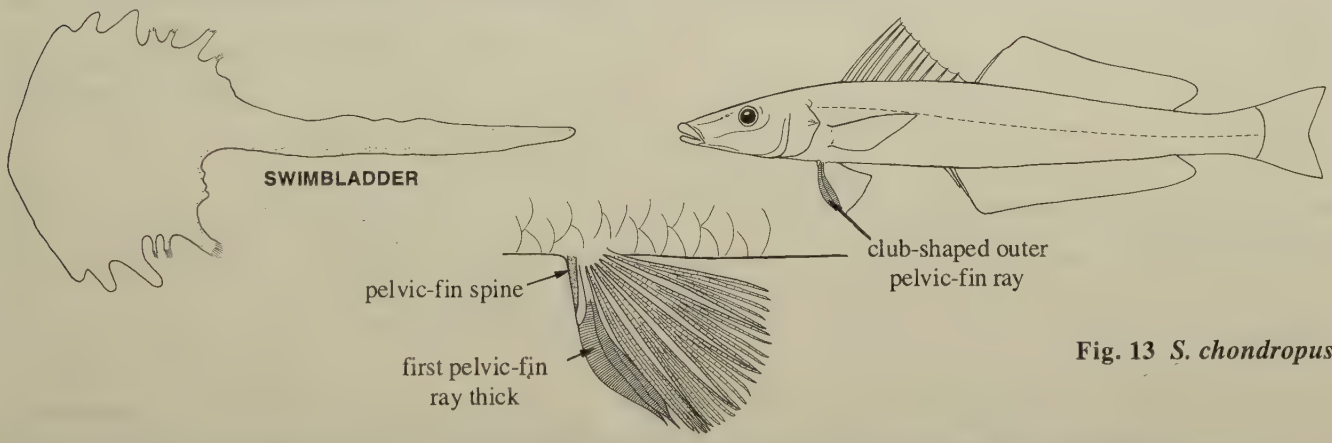


Fig. 13 ***S. chondropus***

3a. Base of pectoral fin with a conspicuous dark brown, black or blue-black blotch or spot; body with irregular dark blotches; dorsal-fin rays 18 to 20; anal-fin rays 17 to 19 (Fig. 14) . .**Sillago aeolus**

3b. Base of pectoral fin without a dark brown or blackish blotch, or spot . . . . . → ***4***

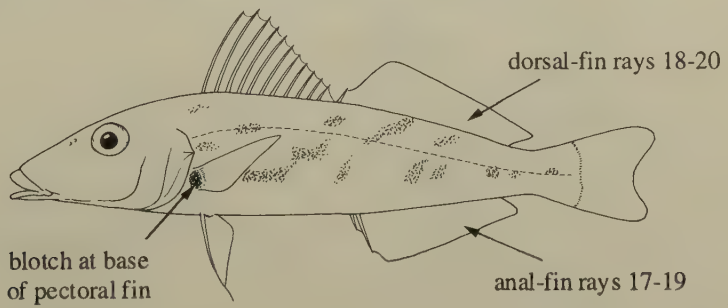


Fig. 14 ***S. aeolus***

4a. Sides of body just below lateral line with a longitudinal row of dusky black spots, and a series of saddle-like black blotches; swimbladder with 2 posterior extensions (Fig. 15) . . . *S. intermedius*

4b. No longitudinal row of dusky black spots along sides below lateral line . . . . . → *5*

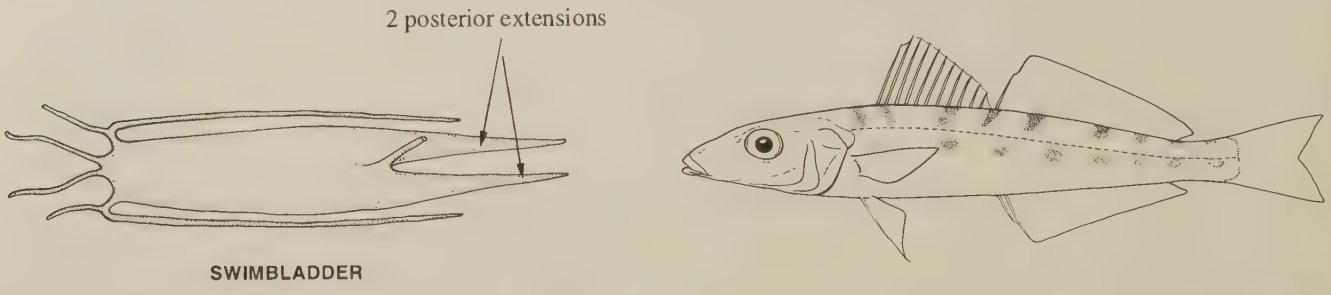


Fig. 15 *S. intermedius*

5a. Lateral-line scales 61 or less; 19 to 21 anal-fin rays (Fig. 16) . . . . . *S. macrolepis*

5b. Lateral-line scales 64 or more . . . . . → *6*

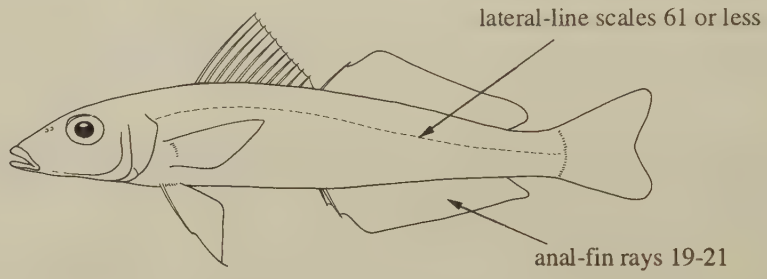


Fig. 16 *S. macrolepis*

6a. Dorsal-fin spines normally XII to XIII . . . . . → 7

6b. Dorsal-fin spines XI . . . . . → *9*

7a. Anal-fin rays 18 to 20 (Fig. 17) . . . . . *S.attenuata*

7b. Anal-fin rays 22 or more . . . . . → *8*

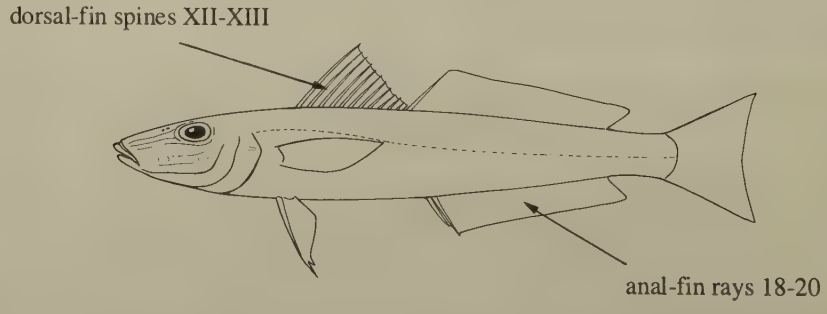
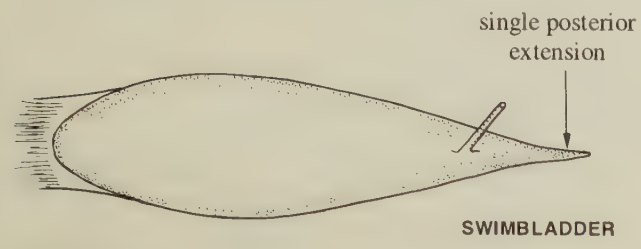
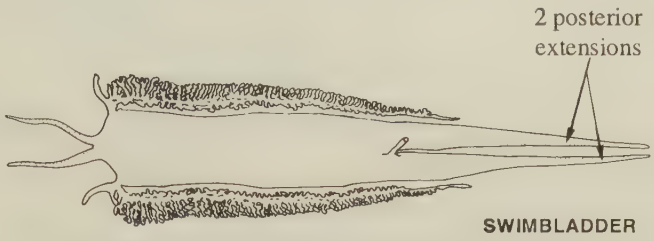


Fig. 17 *S. attenuata*

8a. Snout short, 31 to 38% of head length; posterior extension of swimbladder single (Fig. 18) (Arabian Gulf) . . . . . *S. arabica*

8b. Snout long, 38 to 43% of head length; swimbladder with 2 posterior extensions (Fig. 19) (Taiwan to Japan) . . . . . *S. parvisquamis*





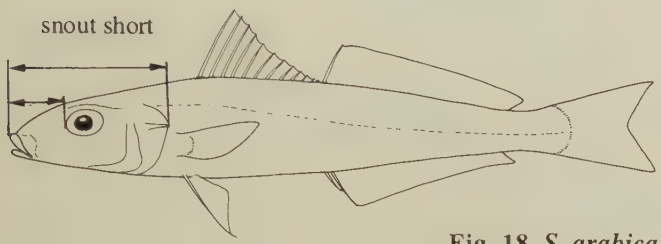


Fig. 18 *S. arabica*

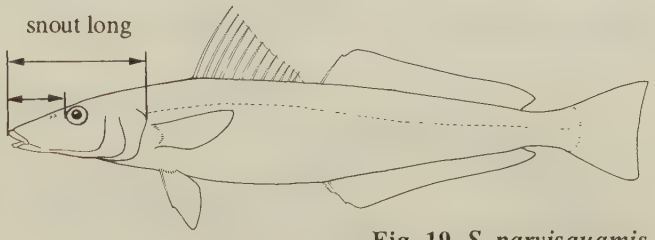


Fig. 19 *S. parvisquamis*

9a. Anal-fin rays 17 to 19 . . . . . →*10*

9b. Anal-fin rays 21 or more . . . . . →*12*

10a. Dorsal-fin rays 19; anal-fin rays 19; eye 14 to 16% of head length (Fig. 20) . . . . . *S. microps*

10b. Dorsal-fin rays 17 or 18; anal-fin rays 17 . . . . . →*11*

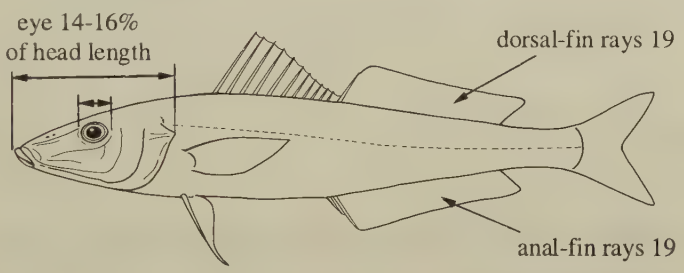


Fig. 20 *S. microps*

11a. Dorsal-fin rays 17 or 18; eye 28 to 29% of head length; upper-cheek scales cycloid (Fig. 21) . . . . . *S. argentifasciata*

11b. Dorsal-fin rays 17; eye 19 to 23% of head length; upper-cheek scales ctenoid (Fig. 22) . . . . . *S. ingenuua*

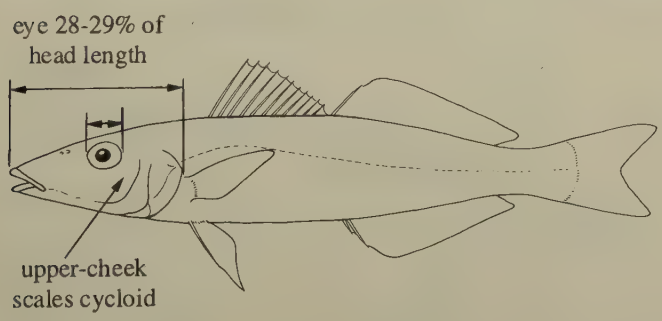


Fig. 21 *S. argentifasciata*

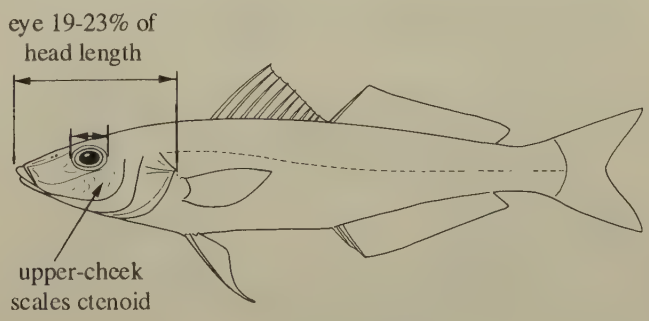


Fig. 22 *S. ingenuua*

12a. Total vertebrae 38; lateral-line scales 76 to 80 (Fig. 23) . . . . . ***S. boutani***

12b. Total vertebrae 35 or less; lateral-line scales usually less than 74 . . . . . → ***13***

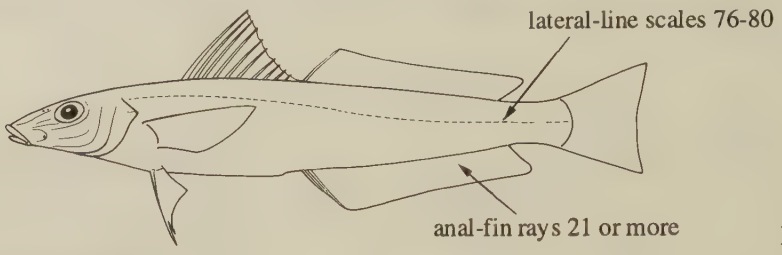
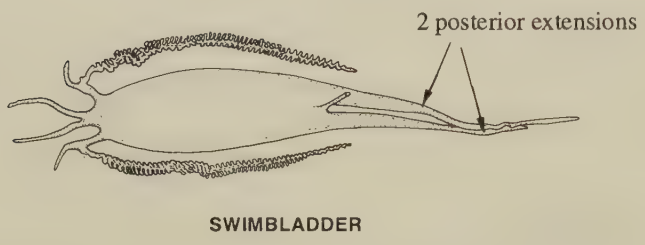


Fig. 23 ***S. boutani***

13a. Swimbladder with 2 posterior extensions (Fig. 24) . . . . . ***S. sihama***

13b. Swimbladder with a single extension . . . . . → ***14***



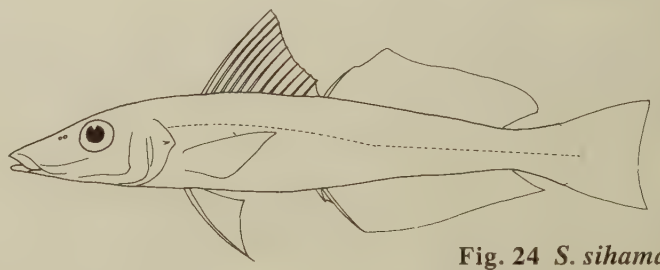
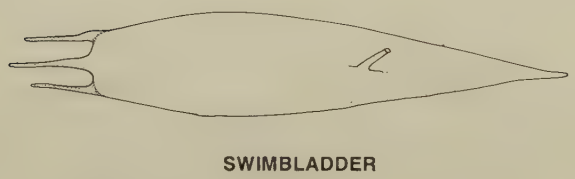


Fig. 24 ***S. sihama***

14a. Three scales between lateral line and origin of dorsal fin (Fig. 25) . . . . . ***S. japonica***

14b. Four or more scales between lateral line and origin of dorsal fin . . . . . →***15***



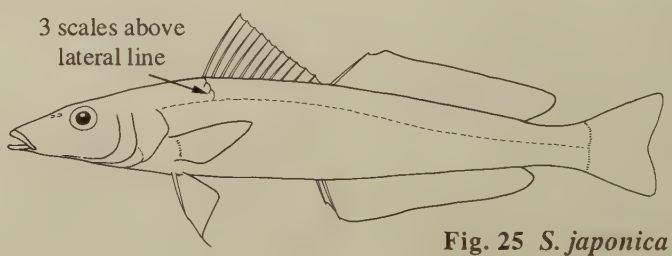


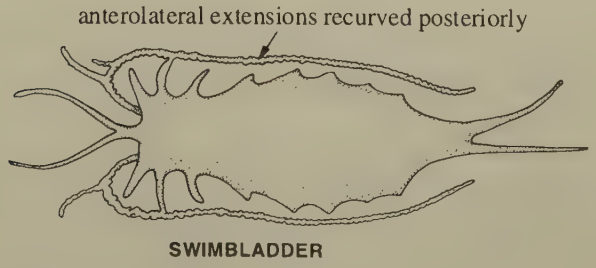
Fig. 25 ***S. japonica***

15a. Swimbladder with anterolateral extensions recurved posteriorly (Figs 26, 28) . . . . . → ***16***

15b. Swimbladder without recurved extensions . . . . . → ***18***

16a. Swimbladder with long anterolateral extensions as in Fig. 26; lateral-line scales 68 to 70 (India) . . . . . ***S. indica***

16b. Swimbladder with lateral extensions shorter than half length of swimbladder; lateral-line scales 64 to 70 . . . . . → ***17***



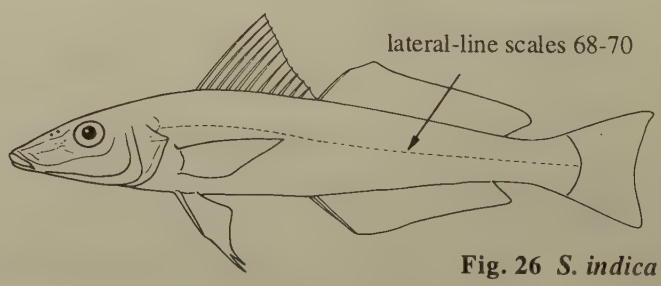


Fig. 26 ***S. indica***

17a. Membrane of second dorsal fin with a more or less continuous grey stripe formed of minute black dots, running parallel to and closer to anterior edge of each ray (Fig. 27) (India) . . . *S. soringa*

17b. Membrane of second dorsal fin without a more or less continuous grey stripe, but with the margin of the second dorsal fin finely spotted with brown or black (Fig. 28) (Thailand and Taiwan) . . . . . *S. asiatica*

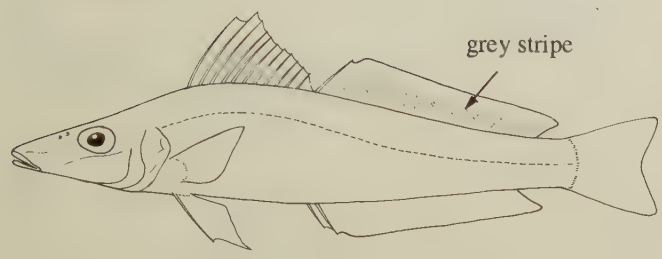


Fig. 27 *S. soringa*

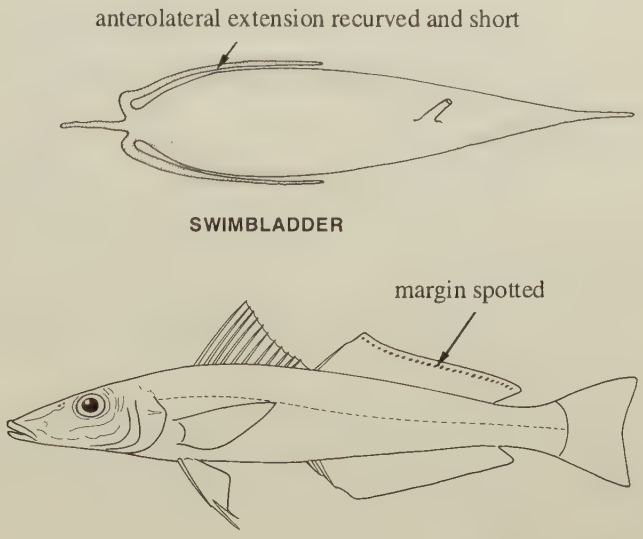
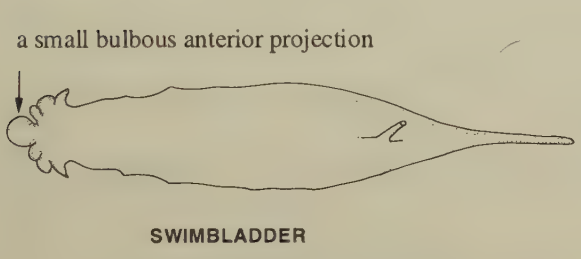
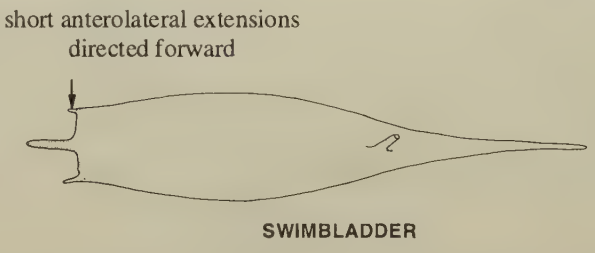


Fig. 28 *S. asiatica*

18a. Second dorsal fin with at least 5 rows of dusky black or black-brown spots; swimbladder with a small bulbous anterior projection (Fig. 29) . . . . . *S. vincenti*

18b. Second dorsal fin without dark spots, but may have the membranes tipped with a dusting of very fine black dots; swimbladder with a short median projection and short anterolateral extensions directed forward (Fig. 30) . . . . . *S. lutea*





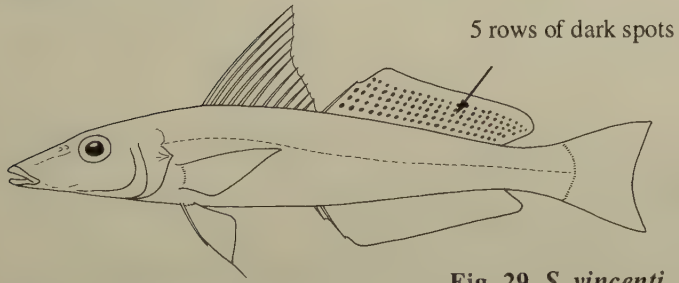


Fig. 29 *S. vincenti*

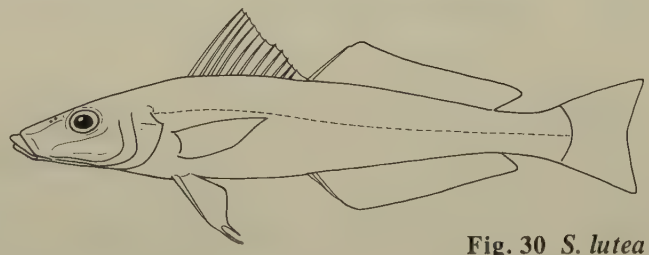


Fig. 30 *S. lutea*

2.2.3 Key to the Australian-New Guinea Genera and Species

1a. Scales very small, 129 to 147 in the lateral-line series (Fig. 31) . . . . . ***Sillaginodes punctata***

1b. Scales not very small, 50 to 84 in the lateral-line series (Fig. 32) . . . . . ***(Sillago)*** → *2*

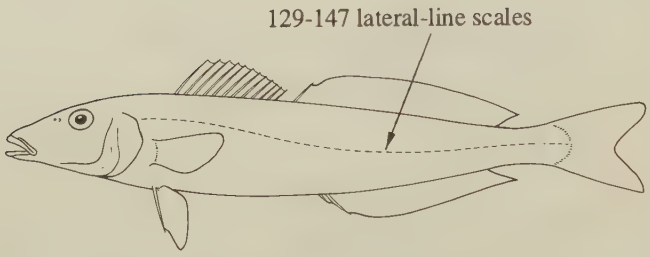


Fig. 31 *Sillaginodes punctata*

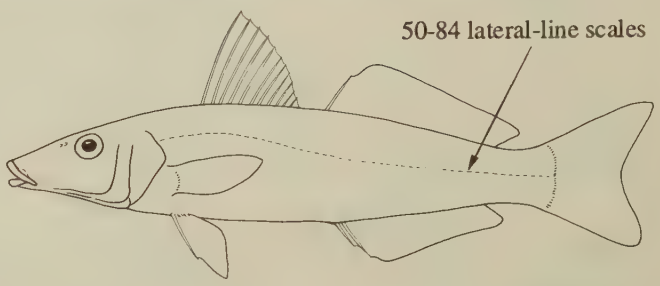


Fig. 32 *Sillago*

2a. A dark spot or blotch on or just preceding the pectoral-fin base (Fig. 33) . . . . . → *3*

2b. No dark spots on or preceding pectoral-fin base . . . . . → *6*

3a. Body without dark blotches or bars on sides and back (Fig. 33) (juveniles up to 9.0 cm may have dark blotches in which case dissection of the swimbladder is necessary) . . . . . ***S. ciliata***

3b. Body coloration not uniform silvery in adults . . . . . → *4*

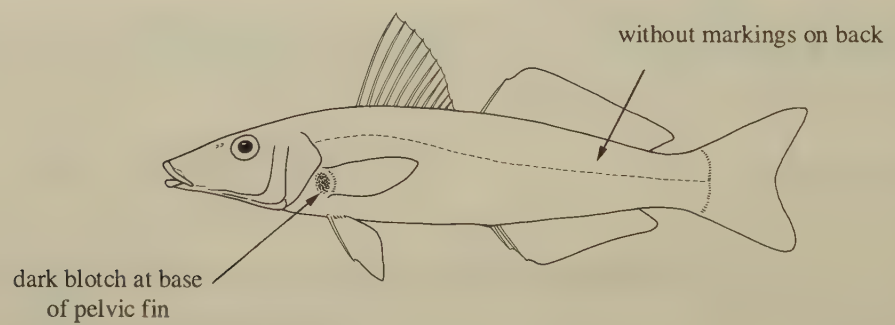


Fig. 33 *S. ciliata*

4a. Body with 8 to 11 oblique rusty brown bars dorsally; dorsal-fin rays 17 to 19; anal-fin rays 16 to 18 (Fig. 34) . . . . . ***S. vittata***

4b. Body with dark blotches not in regular oblique bar . . . . . → *5*

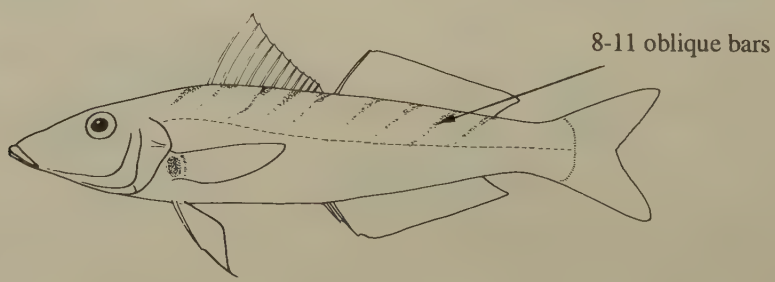


Fig. 34 *S. vittata*

5a. Upper and lower dark blotches on sides joined posteriorly; swimbladder with complex anterolateral extensions recurved posteriorly to the vent (Fig. 35) . . . . . *S. maculata*

5b. Upper and lower dark blotches separate; swimbladder without anterolateral extensions extending to the vent, but with four somewhat branched lobes on each side anteriorly (Fig. 36) . . . . . *S. burrus*

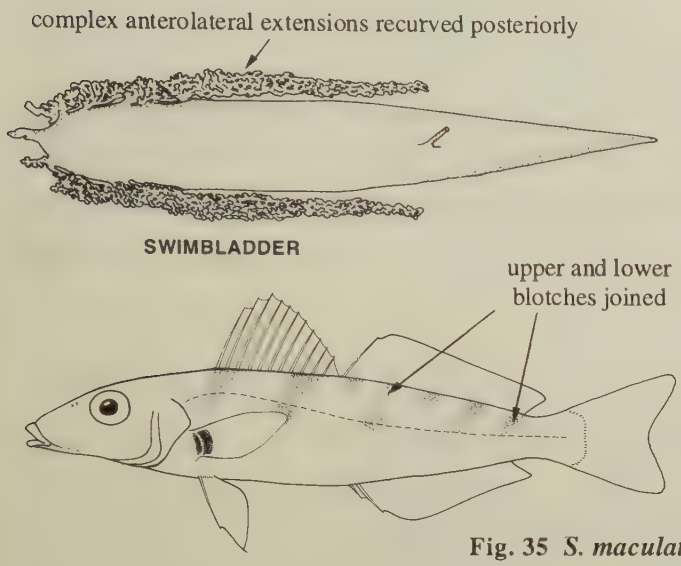


Fig. 35 *S. maculata*

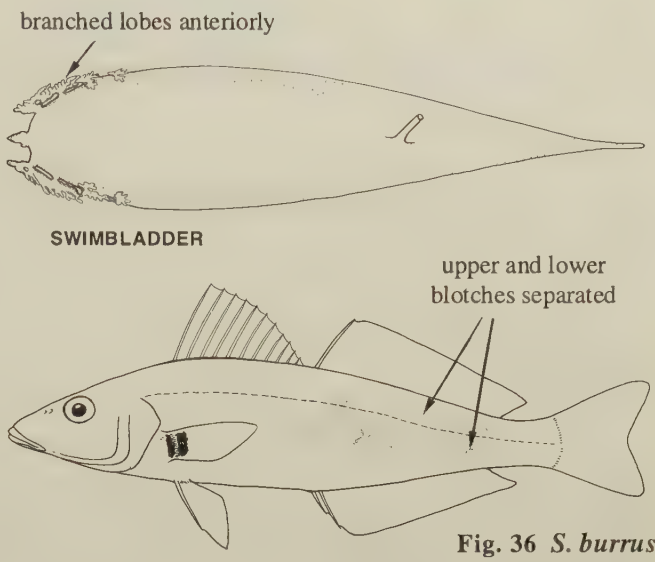


Fig. 36 *S. burrus*

6a. Body with oblique narrow rusty brown bars of rusty-brown to orange spots . . . . . → *7*

6b. No brown bars or blotches on body . . . . . → *8*

7a. A longitudinal row of brown or rusty brown blotches along middle of side on or below lateral line (Fig. 37) . . . . . *S. flindersi*

7b. No longitudinal row of spots on or below lateral line (Fig.38) . . . . . *S. bassensis*

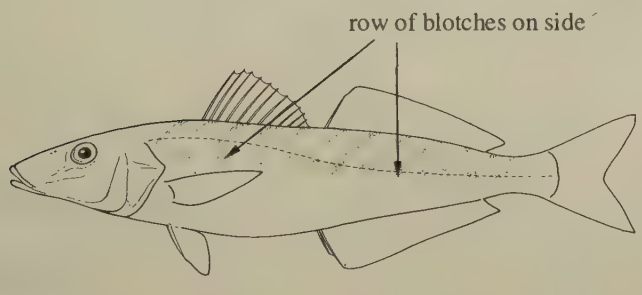


Fig. 37 *S. flindersi*

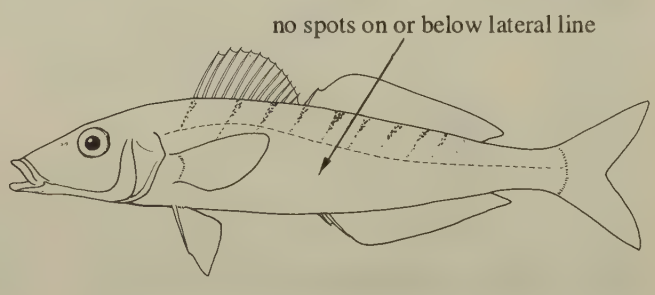


Fig. 38 *S. bassensis*

8a. Dorsal-fin rays 20 to 23 . . . . . → *9*

8b. Dorsal-fin rays 16 to 18 . . . . . → *11*

9a. Anal-fin rays 17 to 20; lateral-line scales 66 to 76; vertebrae 37 (Fig. 39) . . . . . ***S. schomburgkii***

9b. Anal-fin rays 21 to 23; vertebrae 35 or less . . . . . → ***10***

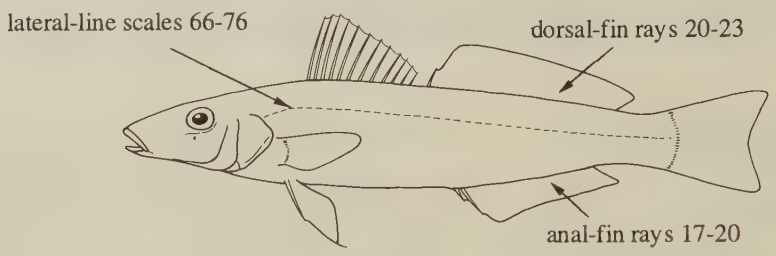
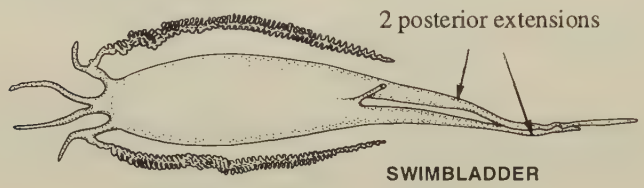


Fig. 39 ***S. schomburgkii***

10a. Swimbladder with two posterior postcoelomic extensions (Fig. 40) . . . . . ***S. sihama***

10b. Swimbladder with a single postcoelomic extension (Fig. 41) . . . . . ***S. lutea***



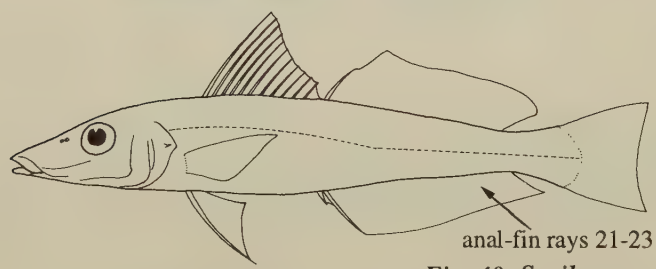
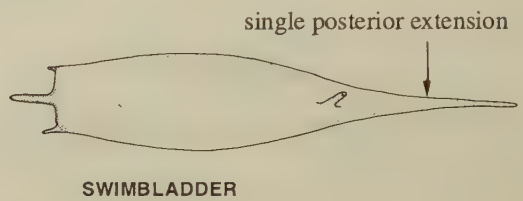


Fig. 40 ***S. sihama***



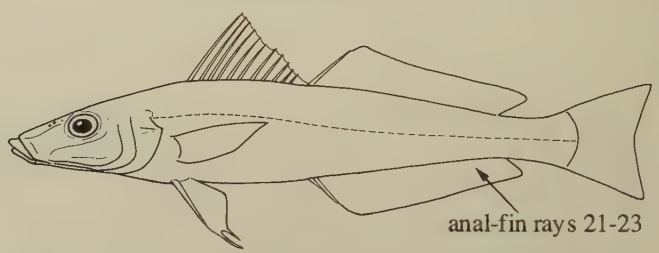
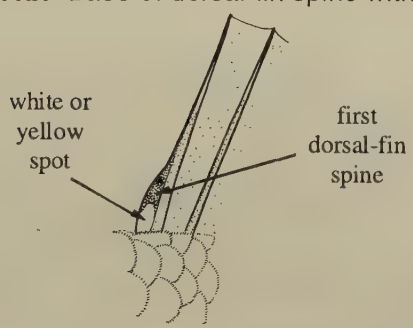


Fig. 41 ***S. lutea***

11a. Base of first dorsal-fin spine with a sharp anterior keel bearing on the lower part a white or pale yellow spot with a black spot above (Fig. 42) . . . . . ***S. robusta***

11b. Base of dorsal-fin spine without a sharp anterior edge and without black spot on base . . . . . → ***12***



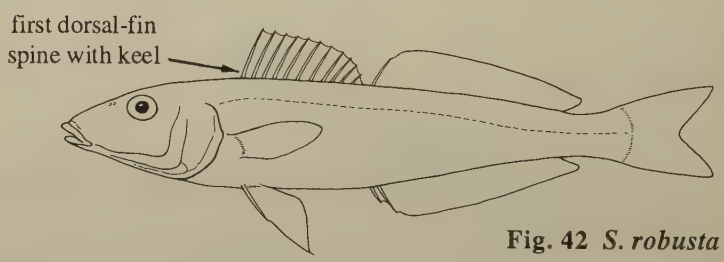


Fig. 42 ***S. robusta***

12a. Lateral-line scales 54 to 61 (Fig. 43) . . . . . ***S. analis***

12b. Lateral-line scales 66 to 70 (Fig.44) . . . . . ***S. ingenuua***

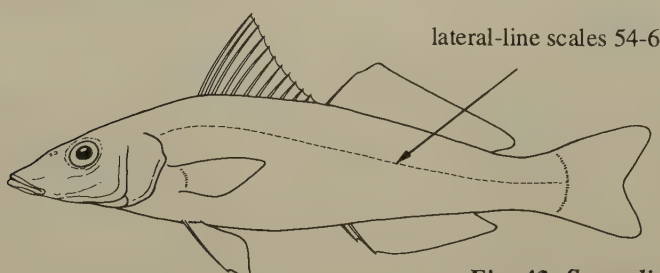


Fig. 43 ***S. analis***

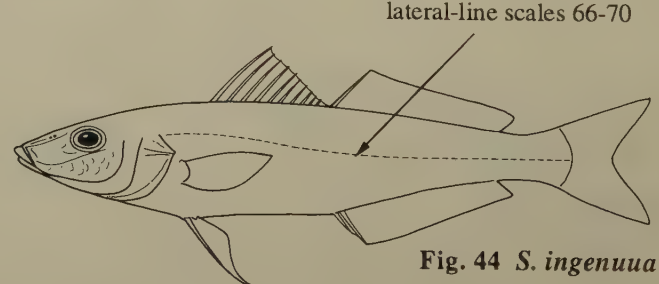


Fig. 44 ***S. ingenuua***

2.3 Information by Species

Sillaginodes Gill, 1862 SILL Silg

Sillaginodes Gill, 1862, type by original designation. Type species, ***Sillago punctata*** Cuvier, 1829.

Diagnostic Features: First dorsal fin with XII or XIII spines and second dorsal fin with I spine and 25 to 27 soft rays; anal fin with II spines and 21 to 24 soft rays. Lateral-line scales 129 to 147. Vertebrae: 20 or 23 abdominal + 5 to 7 modified + 14 to 18 caudal, total of 42 to 44. Swimbladder with a posterior extension but no duct-like process on the ventral surface. One species.

Biology, Habitat and Distribution: See species.

Interest to Fisheries: An important fishery is based on this species in southern Australia.

Species: ***Sillaginodes punctata*** (Cuvier, 1829).

Sillaginodes punctata (Cuvier, 1829) Fig. 45 SILL Silg 1

Sillago punctata Cuvier in Cuvier and Valenciennes, 1829:413 (Port King George).

Synonyms: ***Isosillago maculata*** Macleay, 1879:34, pl. 4, fig. 3 (King George Sound). ***Isosillago punctata***: McCulloch, 1911:59-60. ***Sillaginodes punctatus***: McCulloch, 1927:50, pl. 21, fig. 183a; Waite, 1928:7; Fowler, 1933:431-432; Sandars, 1945:107; Whitley, 1948:19, 1955:331, 1962:105, 1964:43; Scott, 1962:186-187; Scott et al., 1974:208-209, fig.; Last et al., 1983:357 (Tasmania). ***Sillago punctata***: Quoy and Gaimard, 1834:671-672, pl. 1, fig. 1; Günther, 1860:245; Schmeltz, 1869:16, 1879:44; Castelnau, 1872:93; Klunzinger, 1879:370; Macleay, 1881:201; Waite, 1904:31, 1921:100, fig. 152; Stead, 1906a:574, 1908b:66, pl. 36; McCulloch, 1921:60; Fowler, 1930b:654; Roughley, 1951:49, pl. 17; Parrott, 1959:201.

FAO Names: **En** - Spotted sillago; **Fr** - Pêche-madame moucheté; **Sp** - Silago manchado.

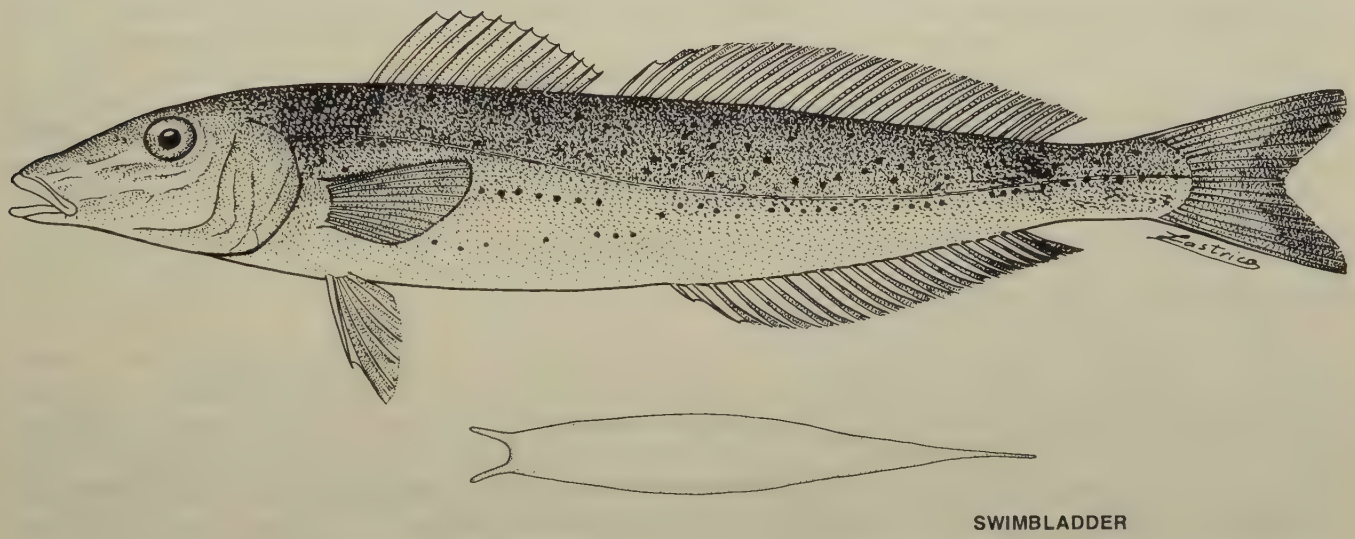


Fig. 45 ***Sillaginodes punctata***

Diagnostic Features: A large species with 129 to 147 lateral-line scales. Swimbladder very elongate with a single slender tapering posterior extension; two anterolateral extensions or horns project anteriorly; anterior part of the swimbladder is bound to the abdominal cavity by short collagen fibres; no duct-like process to the urogenital aperture is present. **Colour:** Pale golden brown, greyish brown, or dark olive-green above; whitish, pale brown or silvery below with reflections of mauve, blue and green when fresh; back and upper sides with oblique rows of small round dark brown to rusty brown spots, lower sides with open-spaced rather scattered round dark spots; belly white, without spots; dorsal fins uniform dark greenish brown to light brown sometimes spotted with darker brown; anal fin, pectorals and ventrals pale brown to hyaline; caudal greenish to brownish, finely dusted with brown.

Geographical Distribution: Jurien Bay, Western Australia southward along the southern coast of Western Australia, South Australia and Victoria (Fig. 46). Ogilby (1893:99) records this species as occasionally reaching as far north as Port Jackson, New South Wales.

Fig. 46

Habitat and Biology: Juveniles are common in tidal estuaries and creeks, particularly those which flow into semi-enclosed bays and coastal "lakes". The juveniles appear to be most abundant on *Zostera* and *Posidonia* seaweed banks in shallow sheltered areas, moving out into the deeper water of the bays at a size of about 10 cm (Robertson, 1977). Sexual maturity is attained at 3 to 4 years of age; the male fish measuring 30 cm fork length and the females 34 cm fork length at the end of their fourth year (Scott, 1954, unpublished). Numerous small fish of 10 to 20 cm are caught in the sheltered areas of large bays, especially during the summer months. Larger fish, although present throughout the bay, are concentrated in deeper water of 2 to 18 m, generally in sand gutters or adjacent to banks. The largest adults observed are normally solitary fish in deeper water of 12 to 18 m depths where they are associated with broken bottom, weed banks or sand gutters. Adult fish are taken along the coastal beaches and may enter estuaries in considerable numbers during March in Western Australia. Adult females with developed ovaries or running ripe are rarely netted in shallow water but have been captured by spearfishermen in 5 to 9 m in coastal bays and offshore waters in southwestern Western Australia. Spawning occurs in May and June (Scott et al., 1974:209).

Size: To 72 cm total length; weight 4.8 kg.

Interest to Fisheries: The main fishery is centred in South Australia from Ceduna in the west to the Gulf of St. Vincent. Smaller fisheries are located in Victoria and southern Western Australia. Spotted or King George whiting are taken by haul seine nets, gillnets or handlines in inshore waters during spring and early summer. A minimum size has been set in Victoria, South Australia and Western Australia. The majority of fish taken are of second to seventh year class. The Australian fishery is reported to be of about $A 5 million. The bulk of the catch is sold in local markets, but some of the South Australian catch is exported to New South Wales and Queensland. The fish is of premium quality and obtains a high price. Marketed fresh whole or filleted. An important recreational fishery is established throughout the range of the species. Recreational fishing gear is limited to handline or rod and line from shore or boats. In South Australia the recreational fishery accounted for some 37% of the total catch during 1979 to 1982, 61% in the Gulf St. Vincent (Jones et al., 1989). Research is now underway on the aquaculture potential of this species.

Local Names: AUSTRALIA: King George whiting, Spotted whiting.

Literature: Gill (1861:505); Hutchins and Swainston (1986:col. pl. 270).

Sillaginopsis Gill, 1861

SILL Si

Sillaginopsis Gill, 1861:505, type by original designation. Type species, ***Sillago domina*** Cuvier in Cuvier and Valenciennes, 1829 (= ***Cheilodipterus panijus*** Hamilton - Buchanan, 1822).

Synonyms: ***Sillaginichthys*** Bleeker, 1874:63, type by original designation. Type species, ***Sillago domina*** Cuvier in Cuvier and Valenciennes, 1829.

Diagnostic Features: Head very depressed; eyes small and partly covered by the constricted orbits; mouth small with the lower jaw shorter than the upper; teeth villiform, in bands on jaws and vomer, the outer row of teeth in the jaws slightly enlarged, with the two anteriormost teeth in the upper jaw larger than the remainder. First dorsal fin with X spines and second dorsal fin with I spine and 25 to 27 soft rays; anal fin with II spines and 24 to 27 soft rays; branchiostegal rays 5 or 6. Scales small, lateral line with 84 to 90 scales. Vertebrae: 15 abdominal + 27 caudal, total of 42. Swimbladder absent or vestigial. One species.

Biology, Habitat and Distribution: Silty bottom of the Bay of Bengal.

Interest to Fisheries: Taken locally by trawl.

Species: ***Sillaginopsis panijus*** (Hamilton-Buchanan, 1822).

Sillaginopsis panijus (Hamilton-Buchanan, 1822) Fig. 47 SILL Si 1

Cheilodipterus panijus Hamilton-Buchanan, 1822:57, 367 (Ganges estuaries).

Synonyms: ***Cheilodipterus panijus***: Day, 1876:315. ***Sillaginopsis domina***: Gill, 1861:505; Fowler, 1930b:654. ***Sillago domina*** Cuvier in Cuvier and Valenciennes, 1829:415, pl. 69 (Pondicherry); Swainson, 1838:205; Cantor, 1850:1003 (Pondicherry); Bleeker, 1853:34, 1859:167; Günther, 1860:246 (description, Bay of Bengal); Day, 1869:299 (Orissa), 1876:315, 1878:264, pl. 58, fig. 3 (Coromandel coast, abundant October, Burma and Malay Archipelago), 1888:791; Lloyd 1907:228 (riverine, winter months); Mookerjee et al., 1946:564 (Port Canning, food items); Hoque and Patra, 1987:205-210 (fecundity). ***Sillago panijus***: Day, 1876:315 footnote; Krishnayya, 1963:391-412.

FAO Names: **En** - Flathead sillago; **Fr** - Pêche-madame camus; **Sp** - Silago chato.

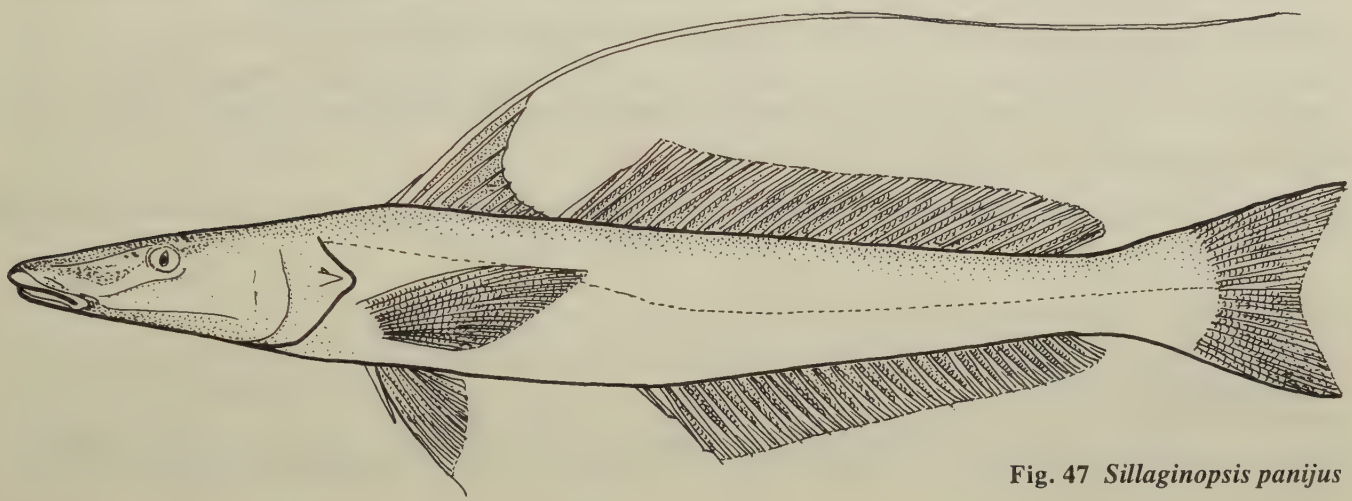


Fig. 47 ***Sillaginopsis panijus***

Diagnostic Features: Head greatly depressed, eye very small. First dorsal fin with X spines and second dorsal fin with I spine and 25 to 27 soft rays; anal fin with II spines and 24 to 27 soft rays. Lateral-line scales 84 to 90. Vertebrae: 15 abdominal + 27 caudal, total of 42.

Geographical Distribution: Pondicherry northward along the Coromandel coast, Ganges delta, Burma, southward to Malaysia and rarely to the Indonesian Archipelago (Fig. 48).

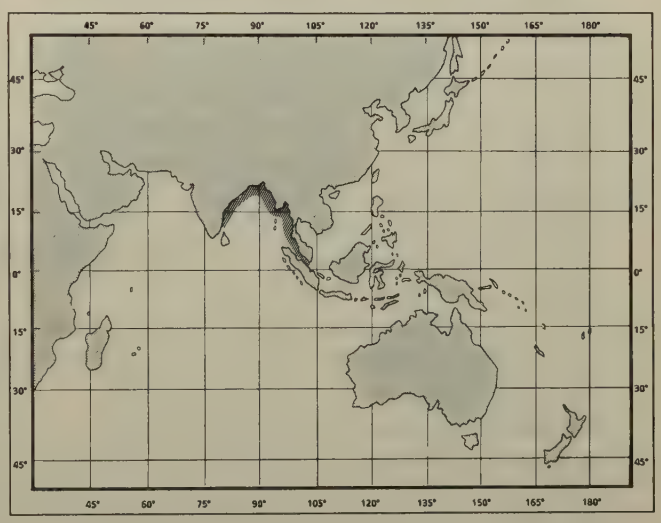


Fig. 48

Habitat and Biology: Krishnayya (1963) studied otoliths and size-age compositions of the commercial catches from the Hooghly estuary and arrived at the conclusion that *S. panijus* probably spawns twice a year during the months November to February and August to September and the juveniles migrate toward the upper reaches during March and April and during December where they remain for two to three months. Sexual maturity is attained at a length of about 120 mm. Cuvier (1829) found numerous small fishes and crustaceans in the gut contents. Mookerjee, Ganguly and Mazumdar (1946) recorded the gut contents of 10 specimens and found them to be feeding primarily on crustaceans, algae, and fish. The small eyes, flattened head, filamentous second dorsal-fin spine, and the lack of a swimbladder suggests demersal adaptation to muddy water conditions.

Size: To 35 cm standard length.

Interest to Fisheries: A small fishery exists along the coast of the Bay of Bengal primarily near or on river deltas. Commercially important fish captured by nets and longlines in the Hooghly and Ganges delta. Marketed fresh.

Local Names: INDIA: Gangetic whiting.

Literature: Fowler (1933:432-433, description); Palekar and Bal (1955:128, anatomy); Misra (1962:231-232, distribution); Dutt and Sujatha (1980:371-374).

Sillago Cuvier, 1817

SILL Sill

Sillago Cuvier, 1817, type by subsequent designation, Gill, 1861:503. Type species, ***Sillago sihama*** (Forsskål, 1775).

Diagnostic Features: Swimbladder present, often complex, with a blind tube (duct-like process) from the ventral surface to just before the anus usually present.

Biology, Habitat and Distribution: See family.

Subgenera and Species of ***Sillago***: McKay (1985) divided the genus ***Sillago*** into 3 subgenera.

The monotypic subgenus ***Sillaginopodys*** is characterised by the reduced pelvic-fin spine situated at the base of a thickened club-shaped outer ray (Fig. 50); swimbladder reduced, without duct-like process and no haemal funnel.

Sillago (Sillaginopodys) chondropus Bleeker, 1849.

The subgenus ***Sillago*** contains 4 species and is characterized by a double post-coelomic extension penetrating the tail region (Fig. 51).

Sillago (Sillago) intermedius Wongratana, 1977
Sillago (Sillago) megacephalus Lin, 1933
Sillago (Sillago) parvisquamis Gill, 1861
Sillago (Sillago) sihama (Forsskål, 1775)

The subgenus ***Parasillago*** contains 24 species and is distinguished by the single post-coelomic extension of the swimbladder (Fig. 52).

Sillago (Parasillago) aeolus Jordan and Evermann, 1902
Sillago (Parasillago) analis Whitley, 1943
Sillago (Parasillago) arabica McKay and McCarthy, 1989
Sillago (Parasillago) argentifasciata Martin and Montalban, 1935
Sillago (Parasillago) asiatica McKay, 1983
Sillago (Parasillago) attenuata McKay, 1985
Sillago (Parasillago) bassensis Cuvier, 1829
Sillago (Parasillago) boutani Pellegrin, 1905
Sillago (Parasillago) burrus Richardson, 1842
Sillago (Parasillago) ciliata Cuvier, 1829
Sillago (Parasillago) flindersi McKay, 1985
Sillago (Parasillago) indica McKay, Dutt and Sujatha, 1985
Sillago (Parasillago) ingenuua McKay, 1985
Sillago (Parasillago) japonica Temminck and Schlegel, 1843
Sillago (Parasillago) lutea McKay, 1985
Sillago (Parasillago) macrolepis Bleeker, 1859
Sillago (Parasillago) maculata Quoy and Gaimard, 1824
Sillago (Parasillago) microps McKay, 1985
Sillago (Parasillago) nierstraszi Hardenberg, 1941
Sillago (Parasillago) robusta Stead, 1908
Sillago (Parasillago) schomburgkii Peters, 1865
Sillago (Parasillago) soringa Dutt and Sujatha, 1983
Sillago (Parasillago) vincenti McKay, 1980
Sillago (Parasillago) vittata McKay, 1985

Key to Species of *Sillago*

1a. Pelvic-fin spine very small and situated at the base of a thickened club-shaped outer pelvic-fin ray; swimbladder reduced, no duct-like process; no modified caudal vertebrae present (subgenus ***Sillaginopodys***) (Figs 49, 50) . . . . . ***S. chondropus***

1b. No club-shaped outer pelvic-fin ray . . . . . → *2*

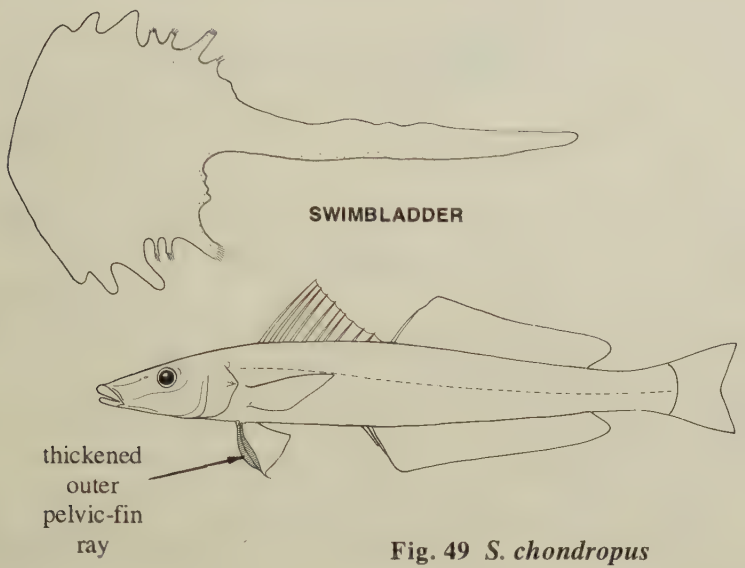


Fig. 49 *S. chondropus*

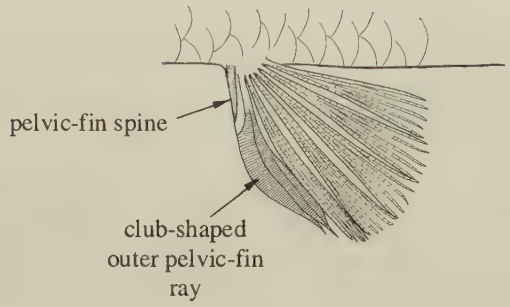


Fig. 50 Pelvic-fin

2a. Swimbladder divided posteriorly into 2 tapering extensions projecting below vertebral column into tail musculature (Fig. 51) . . . . . ***(subgenus Sillago)*** → *3*

2b. Swimbladder with a single posterior extension below vertebral column and entering the tail section (Fig. 52) . . . . . ***(subgenus Parasillago)*** → *6*

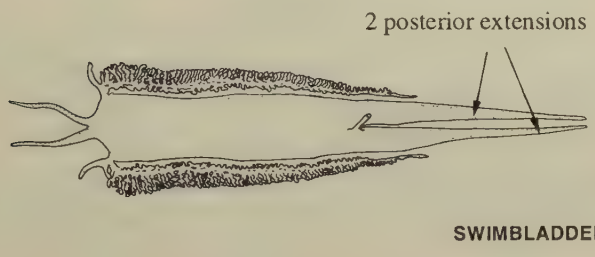


Fig. 51 Subgenus *Sillago*

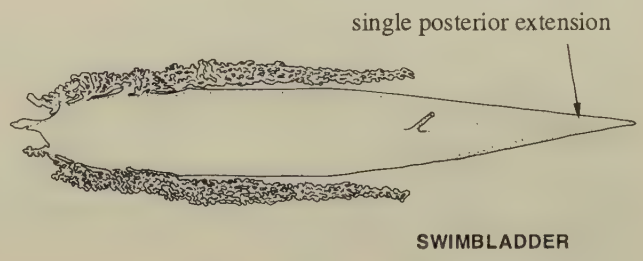


Fig. 52 Subgenus *Parasillago*

3a. Dorsal-fin spines XII or XIII; 79 to 84 lateral-line scales; 39 or 40 vertebrae (Fig. 53) . . . . . ***S. parvisquamis***

3b. Dorsal-fin spines XI; 66 to 72 lateral-line scales; 33 or 34 vertebrae . . . . . → *4*

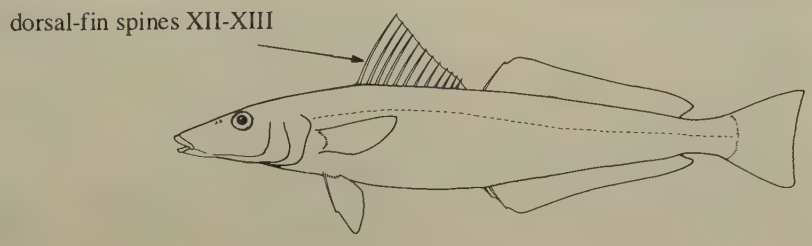


Fig. 53 *S. parvisquamis*

4a. Body with a longitudinal row of dark spots below the lateral line and a series of dark saddle-like blotches on back (Fig. 54) . . . . . *S. intermedius*

4b. Body uniform in coloration . . . . . → *5*

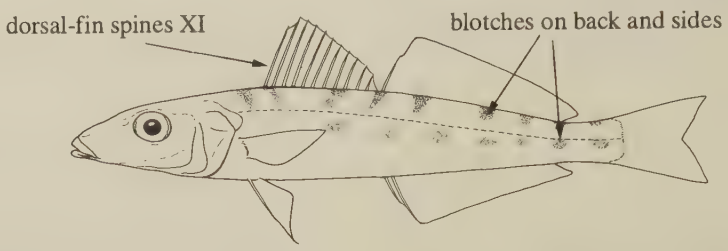


Fig. 54 *S. intermedius*

5a. Head length 24 to 30% of standard length; vertebrae 33 (Fig. 55) . . . . . *S. sihama*

5b. Head length 33% of standard length; vertebral number unknown (a doubtful species) . . . . . *S. megacephalus*

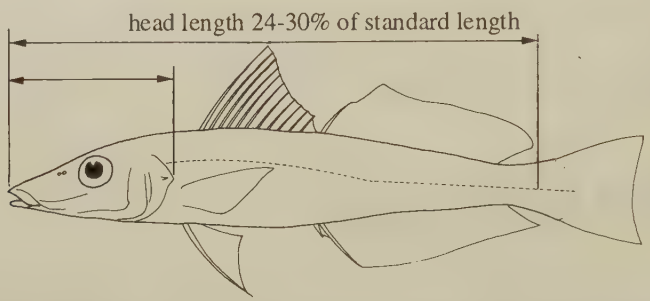


Fig. 55 *S. sihama*

6a. A dark brown, dusky or blue-black spot or blotch on or just preceding the base of the pectoral fin (Fig. 56) . . . . . → *7*

6b. No dark blotch at base of pectoral fin although a bright yellow or orange spot may be present (Fig. 57) . . . . . → *11*

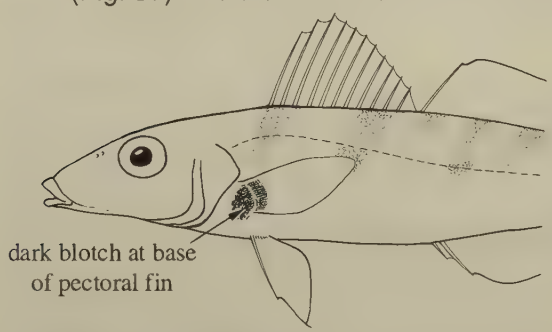


Fig. 56

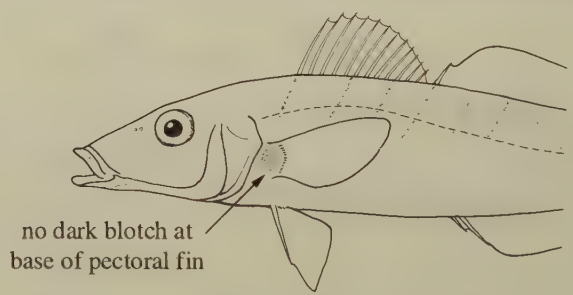
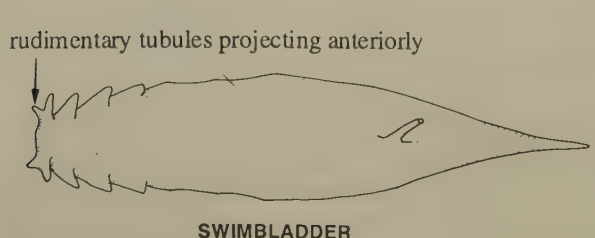


Fig. 57

7a. Body colour uniform in adults (juveniles to 90 mm have darker blotches along the sides and back) with the snout bluish in some large specimens; dorsal fin with XI spines in first fin, and I spine and 16 to 18 soft rays in the second fin; anal fin with II spines and 15 to 17 soft rays; lateral-line scales 60 to 69; vertebrae 14 or 15 + 5 to 8 + 11 to 14, total 32 to 34; swimbladder with rudimentary tubules projecting anteriorly and a series of sawtooth-like pockets laterally (Fig. 58) (eastern Australia) . . . . . *S. ciliata*

7b. Body with dark blotches or rusty brown bars . . . . . → *8*



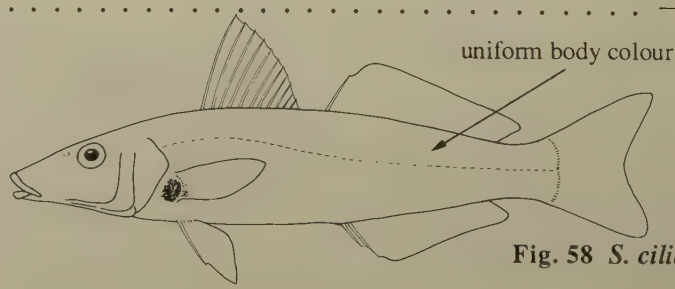
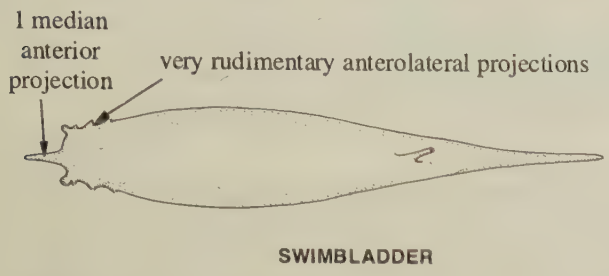


Fig. 58 *S. ciliata*

8a. Body with 8 to 11 oblique well-defined rusty-brown bars dorsally; first dorsal fin with XI spines, and second dorsal fin with I spine and 17 to 19 soft rays; anal fin with II spines and 16 to 18 soft rays; lateral-line scales 65 to 70; vertebrae 13 or 14 + 8 to 12 + 7 to 10, total 32 to 34; swimbladder with a median anterior projection and very rudimentary anterolateral projections (Fig. 59) (western Australia) . . . . . *S. vittata*

8b. Body without well-defined rusty-brown bars . . . . . → *9*



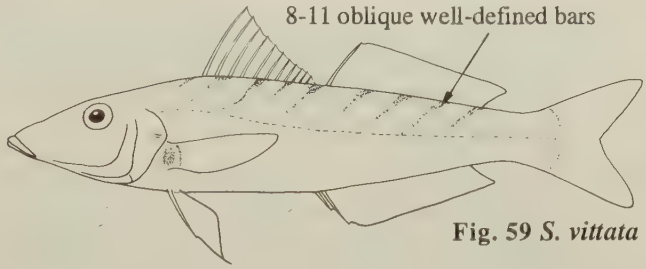
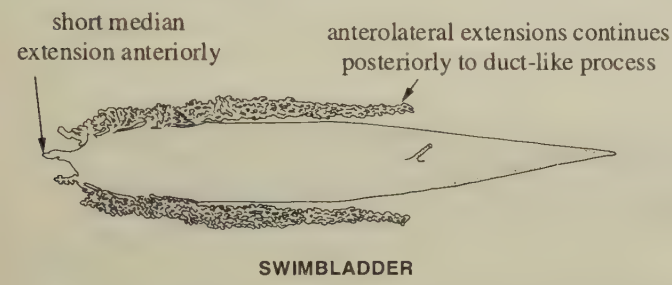


Fig. 59 *S. vittata*

9a. Upper and lower dark blotches on sides joined at least posteriorly; first dorsal fin with XI spines, and second dorsal fin with I spine and 19 to 21 soft rays; anal fin with II spines and 19 or 20 soft rays; lateral-line scales 71 to 75; vertebrae 34 to 36; swimbladder with a short median extension anteriorly and a complex anterolateral extension that continues posteriorly to the duct-like process (Fig. 60) (eastern Australia) . . . . . *S. maculata*

9b. Upper and lower dark blotches separate; swimbladder without complex anterolateral extensions extending well posteriorly to end of abdomen . . . . . → *10*


short median extension anteriorly
anterolateral extensions continues posteriorly to duct-like process
SWIMBLADDER

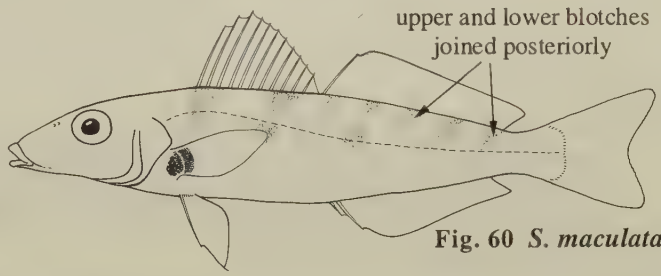


Fig. 60 *S. maculata*

10a. Swimbladder with four rudimentary anterolateral extensions that are normally convoluted ; usually 19 or 20 anal-fin rays; usually 35 vertebrae (Fig. 61) (northern coast of Australia, southern New Guinea and Indonesia) . . . . . *S. burrus*

10b. Swimbladder with three rudimentary anterolateral extensions that may be simple or convoluted; usually 18 anal-fin rays; vertebrae 34 (Fig. 62) (western Pacific except Australia and southern New Guinea) . . . . . *S. aeolus*

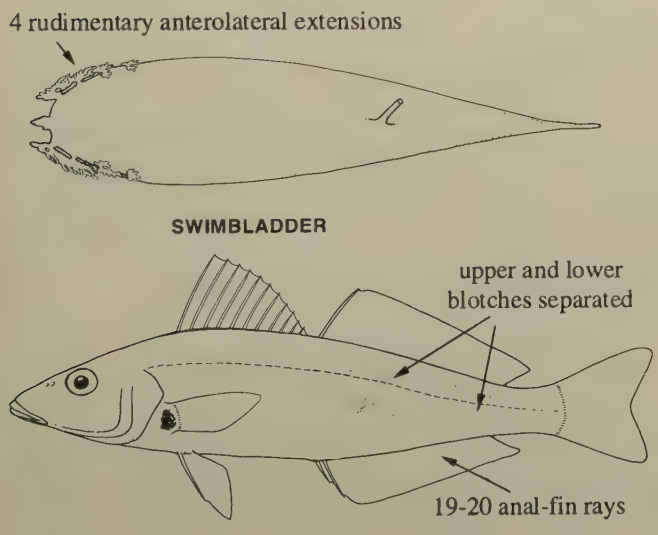


Fig. 61 *S. burrus*

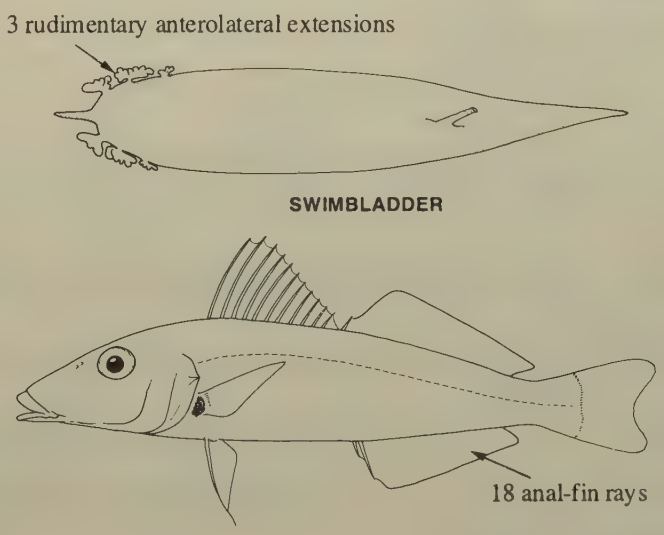


Fig. 62 *S. aeolus*

11a. Body with oblique narrow rusty brown bars that may be partly broken into lines of more or less contiguous rusty brown or orange-brown spots (Figs 63, 64) . . . . . → *12*

11b. Body without oblique rusty brown bars; some faint dark blotches or small spots may be present in juveniles less than 100 mm standard length . . . . . → *13*

12a. A longitudinal row of brown or rusty brown blotches along middle of side on or below lateral line; body pale, not silvery; upper oblique bars not formed of lines of contiguous rusty brown spots; midlateral silvery stripe generally indistinct; vertebrae 13 + 9 to 11 + 9 to 11 (Fig. 63) (southeastern Australia) . . . . . *S. flindersi*

12b. No longitudinal row of brown or rusty brown blotches on or below lateral line; belly silvery; upper oblique bars usually formed of lines of contiguous rusty brown to orange-brown spots; midlateral silvery stripe conspicuous; vertebrae 12 to 14 + 12 to 14 + 7 to 9 (Fig. 64) (western Australia, southern Australia and western Victoria . . . . . *S. bassensis*

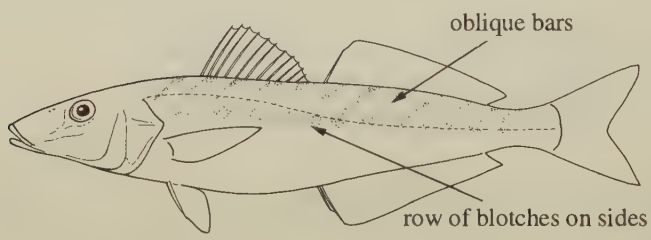


Fig. 63 *S. flindersi*

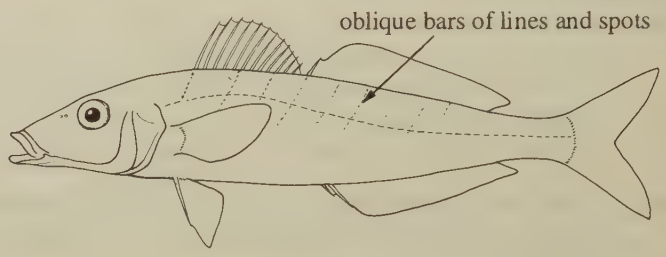
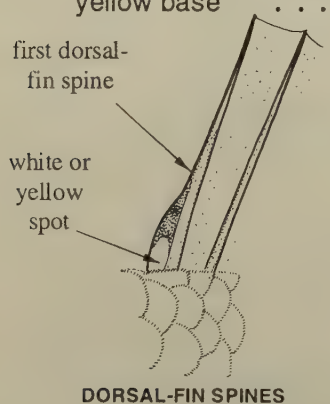


Fig. 64 *S. bassensis*

13a. Base of first dorsal-fin spine of adults with a sharply keeled anterior edge bearing on the lower part a white or pale yellow spot with a black or black-brown spot above; first dorsal fin with XI spines, and second dorsal fin with I spine and 16 to 18 soft rays; anal fin with II spines and 16 to 19 soft rays; lateral-line scales 64 to 70; vertebrae 13 + 8 to 12 + 8 to 12, total 33 (Fig. 65) (southern Australia) . . . . . *S. robusta*

13b. Base of first dorsal-fin spine not keeled and without a black spot or blotch above a white or yellow base . . . . . → *4*



DORSAL-FIN SPINES

Fig. 65 *S. robusta*

14a. Total vertebrae 37 to 40; lateral-line scales usually more than 73 (except some *S. schomburgkii*) . . . . . → *15*

14b. Total vertebrae 32 to 36; lateral-line scales usually less than 73 (except *S. japonica* and some *S. indica*) . . . . . → *18*

15a. Anal-fin rays 21 to 24 . . . . . → *16*

15b. Anal-fin rays 17 to 20 . . . . . → *17*

16a. Dorsal-fin rays 21; snout 39 to 40% of head length; abdominal vertebrae 13 or 14; modified vertebrae 3 or 4 (Fig. 66) (Gulf of Tongking and China) . . . . . *S. boutani*

16b. Dorsal-fin rays 22 to 24; snout 31 to 38% of head length; abdominal vertebrae 15 or 16; modified vertebrae 0 or 1 (Fig. 67) (Arabian Gulf) . . . . . *S. arabica*

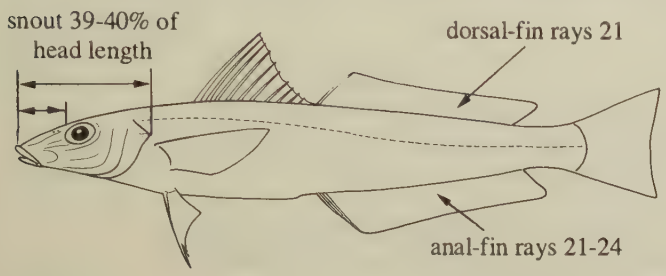


Fig. 66 *S. boutani*

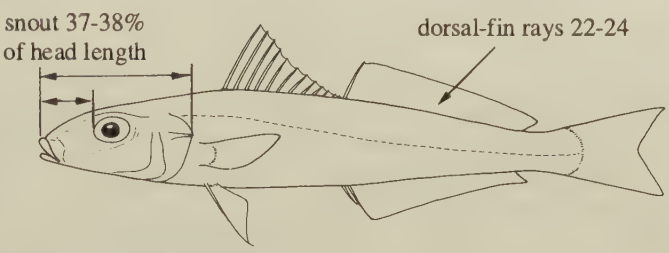
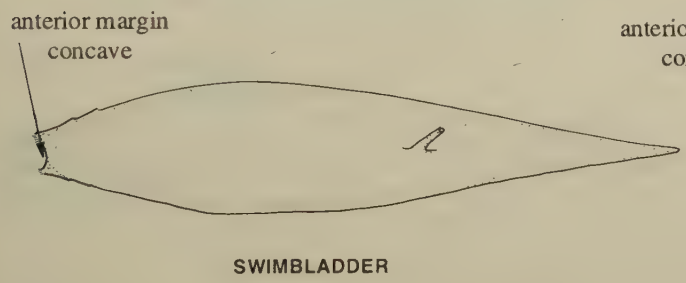
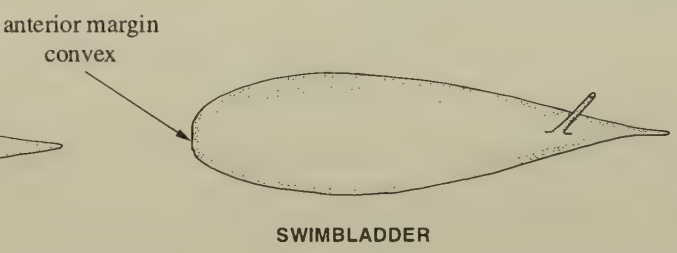


Fig. 67 *S. arabica*

17a. Anterior margin of swimbladder concave; first dorsal fin with X to XII (mostly XI) spines, and second dorsal fin with I spine and 19 to 22 soft rays; lateral-line scales 66 to 76; vertebrae 16 or 17 + 8 to 11 + 10 to 13, total 37 (Fig. 68) (western Australia and South Australia) . . . . . *S. schomburgkii*

17b. Anterior margin of swimbladder convex; first dorsal fin with XII to XIII (mostly XII) spines, and second dorsal fin with I spine and 19 to 21 soft rays; lateral-line scales 73 to 77; vertebrae 15 + 2 + 20, total counts range from 37 to 39; body with faint to distinct dark blotches in 3 series laterally (Fig. 69) (Arabian Gulf) . . . . . *S. attenuata*





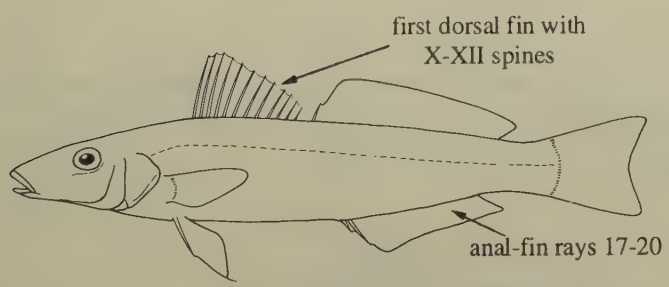


Fig. 68 *S. schomburgkii*

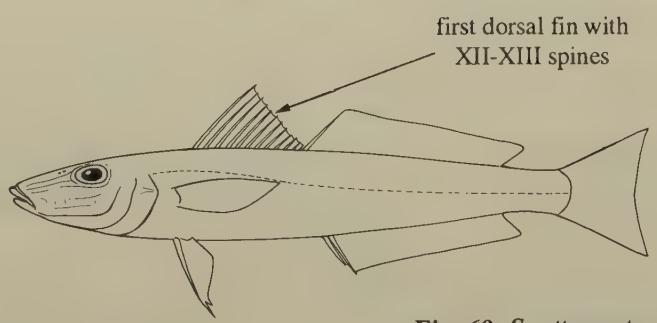


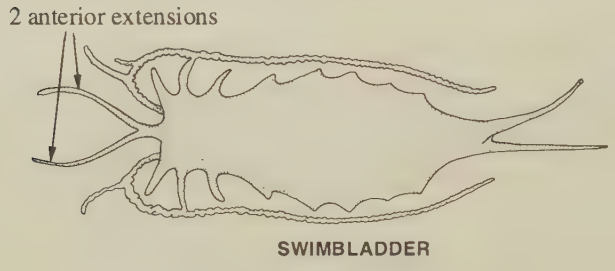
Fig. 69 *S. attenuata*

18a. Swimbladder with anterolateral extensions recurved posteriorly (Fig. 70) . . . . . → *19*

18b. Swimbladder without posteriorly recurved anterolateral extensions (Fig. 75) . . . . . → *21*

19a. Swimbladder with 2 anterior extensions in addition to the anterolateral extensions extending posteriorly (Fig. 70); lateral-line scales 68 to 70 (India) . . . . . *S. indica*

19b. Swimbladder with a single anterior extension in addition to the posteriorly directed anterolateral extensions (Fig. 72) . . . . . → *20*



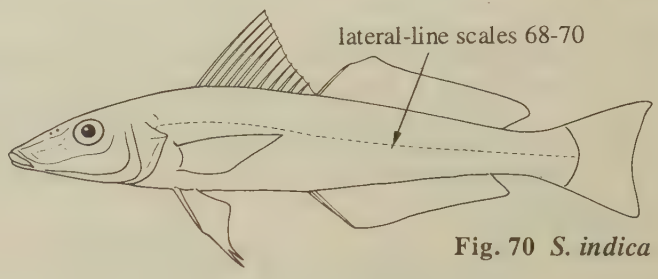
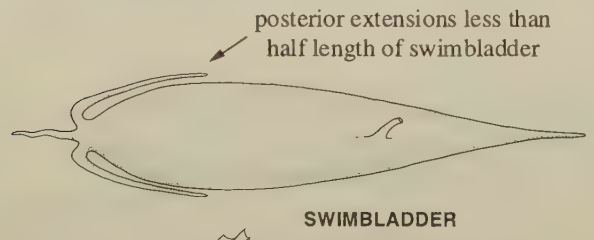


Fig. 70 *S. indica*

20a. Membrane of second dorsal fin with a more or less continuous grey stripe formed of minute black dots running parallel to and closer to anterior edge of each ray; extensions of swimbladder extend to less than half length of swimbladder (Fig. 71) (India) . . . . . *S. soringa*

20b. Membrane of second dorsal fin without a more or less continuous grey stripe but with margin of fin finely spotted with brown or black; extensions of swimbladder extend posteriorly to almost half length of swimbladder (Fig. 72) (Thailand and Taiwan) . . . . . *S. asiatica*



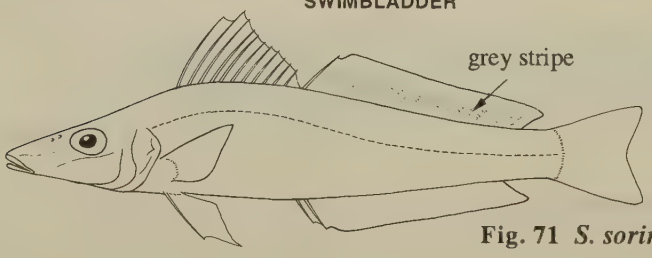
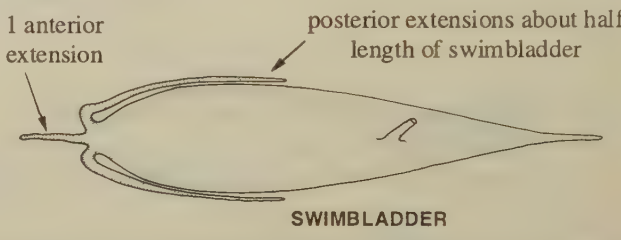


Fig. 71 *S. soringa*



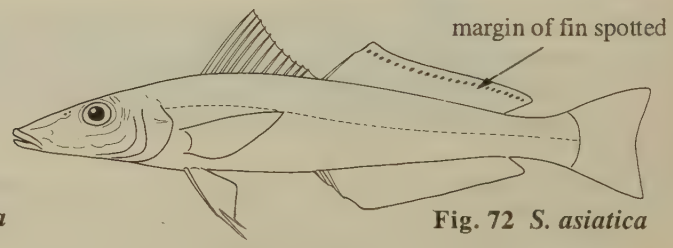


Fig. 72 *S. asiatica*

21a. Lateral-line scales 61 or less (Fig. 73) . . . . . → *22*

21b. Lateral-line scales 64 or more . . . . . → *23*

22a. Anal-fin rays 14 to 17 (Fig. 73) (southern New Guinea and northern Australia) . . . . . *S. analis; S. nierstraszi*

22b. Anal-fin rays 19 to 21 (Fig. 74) (Indonesia to Philippines, excluding Australia) . . . . . *S. macrolepis*

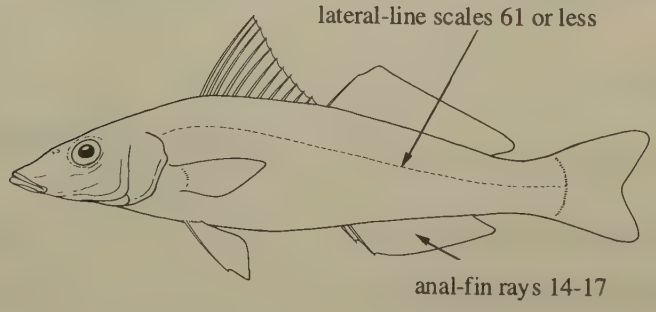


Fig. 73 *S. analis*

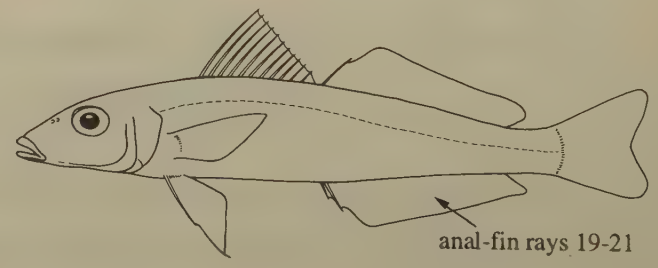


Fig. 74 *S. macrolepis*

23a. Anal-fin rays 21 to 24 . . . . . → *24*

23b. Anal-fin rays 17 to 19 . . . . . → *26*

24a. Swimbladder with a small bulbous anterior projection and without anterolateral extensions projecting anteriorly (Fig. 75) (southwestern India) . . . . . *S. vincenti*

24b. Swimbladder with a pointed median anterior extension and anterolateral extensions projecting anteriorly (Figs 76, 77) . . . . . → *25*

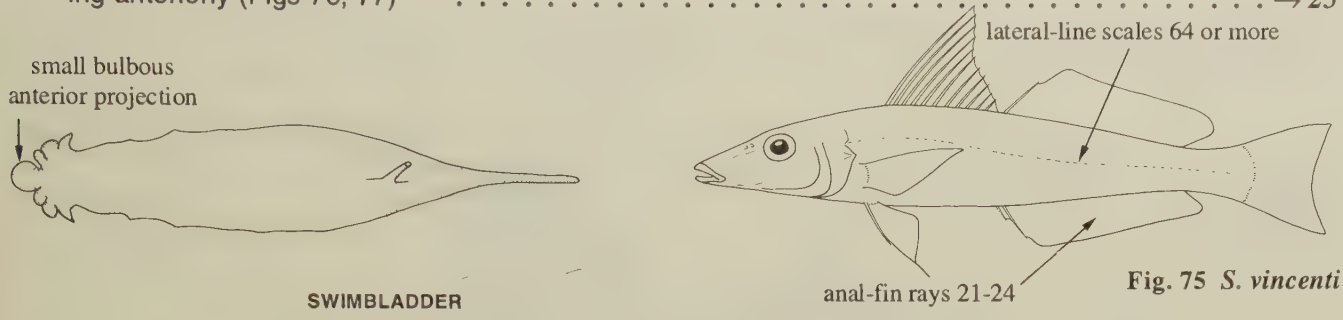
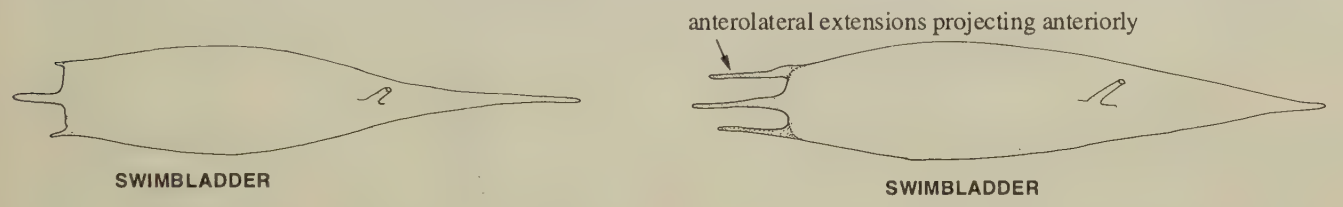


Fig. 75 *S. vincenti*

25a. Scales between lateral line and base of first dorsal-fin spine 5; usually 13 abdominal vertebrae; small species (Fig. 76) (northern Australia to India and Sri Lanka) . . . . . *S. lutea*

25b. Scales between lateral line and base of first dorsal-fin spine 3; usually 14 abdominal vertebrae; moderate species (Fig. 77) (Japan, Korea, China and Taiwan) . . . . . *S. japonica*



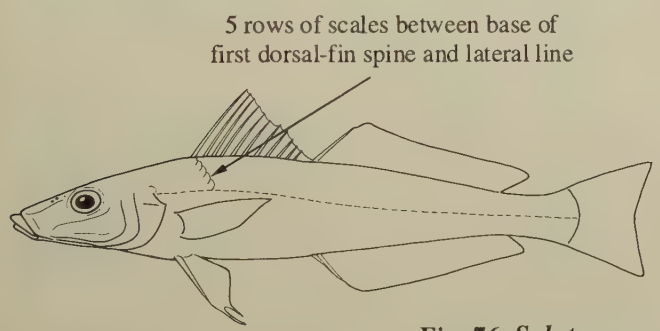


Fig. 76 *S. lutea*

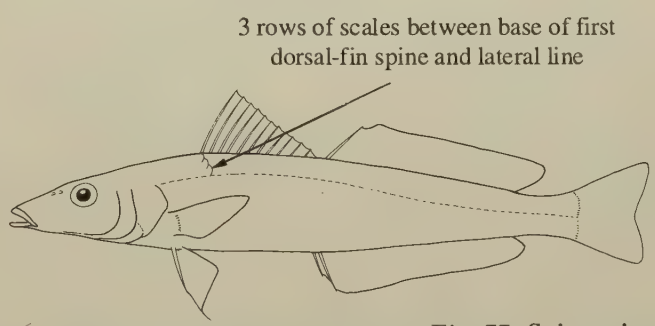


Fig. 77 *S. japonica*

26a. Dorsal-fin rays 19; anal-fin rays 19; cheek scales cycloid; vertebrae 13 + 5 + 16, total 34; eye diameter 14 to 16% of head length (Fig. 78) (Taiwan) . . . . . *S. microps*

26b. Dorsal-fin rays 17 or 18; anal-fin rays 17; eye more than 19% of head length . . . . . → *27*

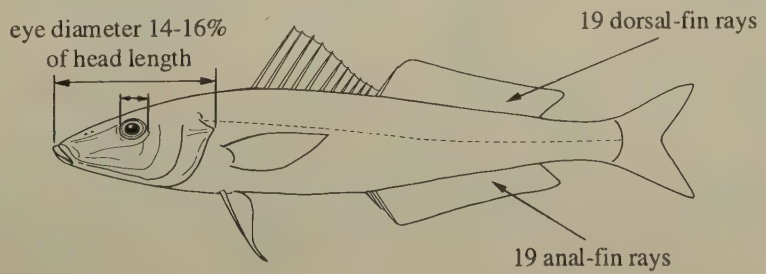


Fig. 78 *S. microps*

27a. Dorsal-fin rays 17; cheek scales ctenoid; vertebrae 13 + 9 to 11 + 9 to 11, total 33; eye diameter 19 to 23% of head length; no wide brilliant silvery stripe on side (Fig. 79) (Thailand, India and northern Australia) . . . . . ***S. ingenuua***

27b. Dorsal-fin rays 17 or 18; cheek scales with upper row cycloid and lower 2 rows ctenoid; eye diameter 28 to 29% of head length; a wide brilliant silvery stripe on side (Fig. 80) (Lumbucan Island, Philippines) . . . . . ***S. argentifasciata***

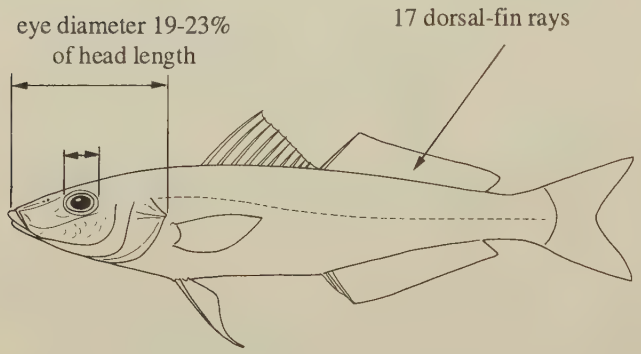


Fig. 79 *S. ingenuua*

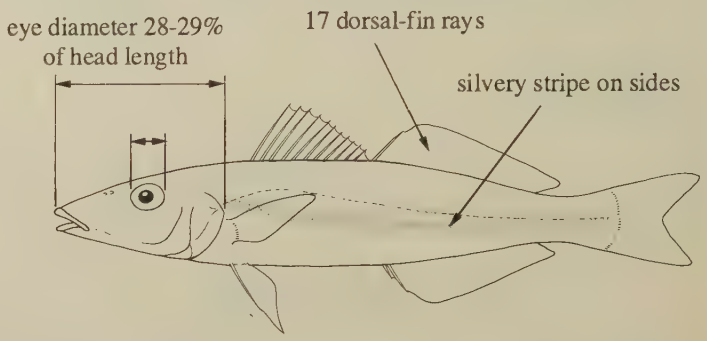


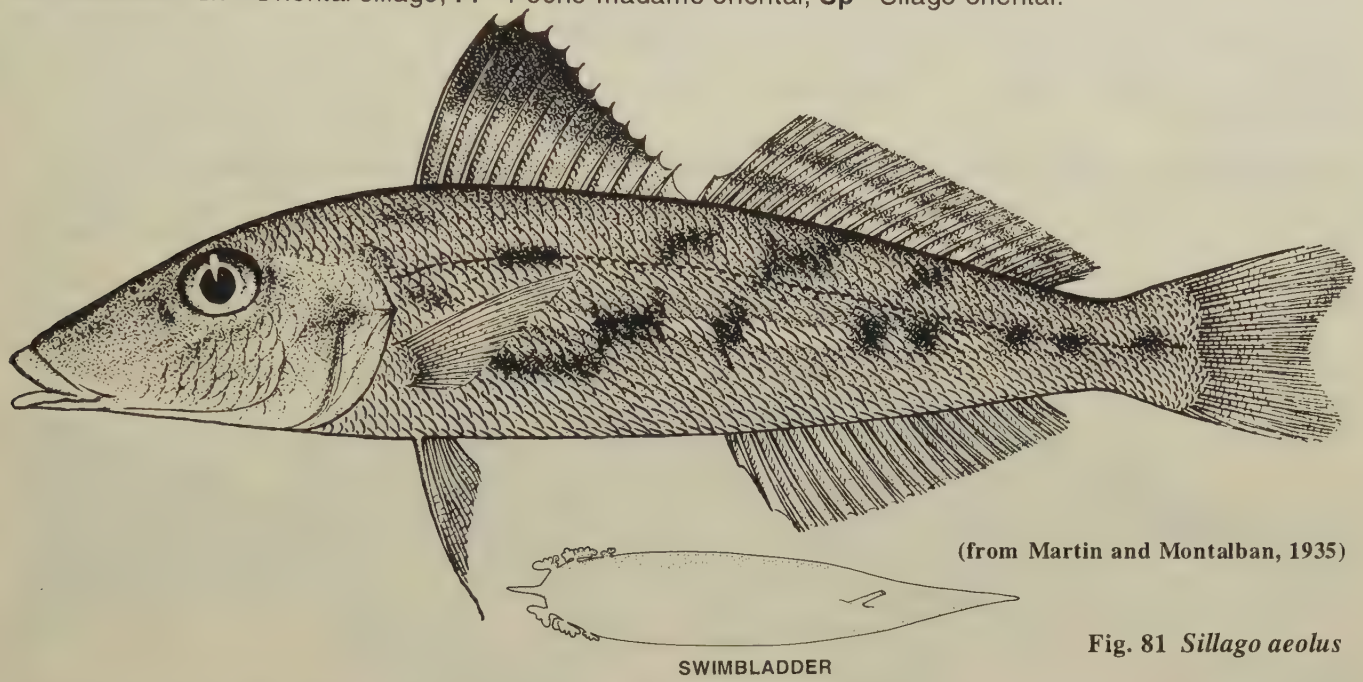
Fig. 80 *S. argentifasciata*

Sillago aeolus Jordan and Evermann, 1902 Fig. 81 SILL Sill 5

Sillago aeolus Jordan and Evermann, 1902:360, fig. 24 (Keerun, Formosa).

Synonyms: ***Sillago macrolepis*** (non ***Sillago macrolepis*** Bleeker): Evermann and Seale, 1907:187. ***Sillago maculata*** (non ***Sillago maculata*** Quoy and Gaimard): Bleeker, 1858:161 (Indonesian localities), 1874:71 (part); Kner, 1865:127; Pellegrin, 1905:83; Seale, 1914:69 (Hong Kong); Weber and de Beaufort, 1931:174 (part); Fowler, 1933:423-425 (part, localities), 1935:150, 1937:238, 1949:52; Martin and Montalban, 1935:224-225, pl. 1, fig. 2; Smith, 1949:204 (South Africa); Suvatti, 1950:394 (Bangkok, Rayong); Herre, 1953:478-479 (part, many localities); Palekar and Bal, 1955:128 (part); Munro, 1955:122 (Ceylon), 1958:178; Scott, 1959:56 (Malaysia); Shao and Chang, 1978:5, 1979:695-705; Dutt and Sujatha, 1980:372; McKay, 1980:383-384; Masuda et al., 1984:151, pl. 134-B; Sano and Mochizuki, 1984:137-141, fig. 1A. ***Sillago*** (***Parasillago***) ***maculata aeolus***: McKay, 1985:27-28; Shao et al., 1986:147.

FAO Names: **En** - Oriental sillago; **Fr** - Pêche-madame oriental; **Sp** - Silago oriental.



(from Martin and Montalban, 1935)

Fig. 81 *Sillago aeolus*

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 18 to 20 soft rays; anal fin with II spines and 17 to 19 (usually 18) soft rays. Lateral-line scales 67 to 72. Vertebrae: 13 or 14 abdominal + 4 to 7 modified + 14 to 16 caudal, 34 total. Swimbladder with three rudimentary anterolateral extensions instead of four; differs from ***Sillago maculata*** in lacking well developed anterolateral extensions reaching to level of vent. **Colour**: Very similar to ***Sillago burrus*** but has the most posterior mid-lateral dark brown blotch elongate and reaching caudal flexure.

Geographical Distribution: Singapore, Thailand, China, Hong Kong, Taiwan, Philippines and southern Japan. Possibly distributed throughout the Indo-West Pacific from Delagoa Bay, southern Africa to Okinawajima, Japan, but not recorded from Australia or southern New Guinea (Fig. 82).

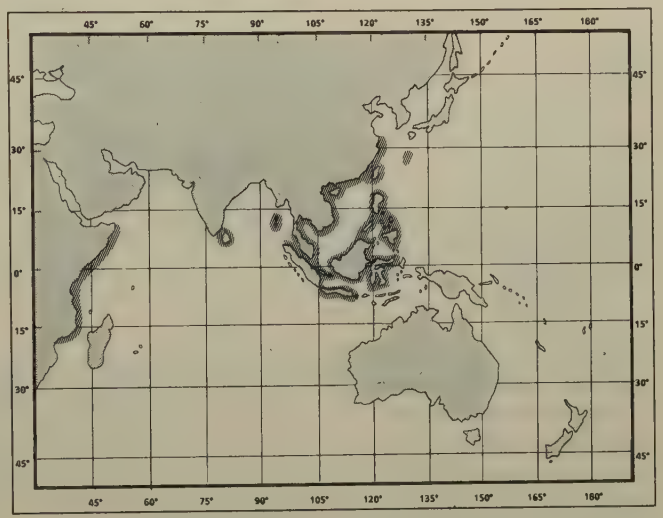


Fig. 82

Habitat and Biology: Little known. Occurs in a depth range from 0 to 60 m. Maxwell (1921) records juveniles burrowing in the sand.

Size: To 30 cm standard length.

Interest to Fisheries: Small local fisheries exist throughout the range of this species, particularly where bottom trawls are employed. The flesh is prone to spoil rapidly and the Oriental sillago is not considered as highly as the inshore sillaginids.

Local Names: AUSTRALIA: Oriental trumpeter whiting; JAPAN: Hoshi-gisu; MALAYSIA: Ebi, Bulus-bulus, Bêbulus, Kêdondong; PHILIPPINES: Oso-so, Asuhos; SOUTH AFRICA: Gevlekte sillago; TANZANIA: Mtambaanchi, Tambanji, Sondo.

Literature: Jordan and Richardson (1909:192, fig. 18); McKay (1985).

Remarks: *Sillago aeolus* has not been found in association with *S. burrus* or *S. maculata*. Specimens of this well patterned complex are required from Indonesia where 2 species may be sympatric.

Sillago analis Whitley, 1943 | Fig. 83 | SILL Sill 6

Sillago analis Whitley, 1943:184 (Shark's Bay, Western Australia).

Synonyms: *Sillago ciliata* (non *Sillago ciliata* Cuvier): Paradice and Whitley, 1927:89; Taylor, 1964:174 (description).

FAO Names: **En** - Golden lined sillago; **Fr** - Pêche-madame doré; **Sp** - Silago aureolineado.

Fig. 83 ***Sillago analis***
(after Grant, 1972)

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 16 to 18 soft rays; anal fin with II spines and 14 to 17 soft rays. Lateral-line scales 54 to 61. Vertebrae: 13 or 14 abdominal + 4 to 8 modified + 11 to 15 caudal, 33 or 34 total. The shape of the swimbladder is very similar to *S. ciliata*. **Colour**: No dark spot at base of pectoral fin; Body light silvery, slightly darker to dusky above; a dull golden silver to golden yellow stripe below lateral line; pelvic and anal fins pale yellow to bright yellow; pectoral fin with a darker dusting of fine black-brown spots.

Geographical Distribution: Shark Bay, Western Australia, Northern Territory, Queensland south to Moreton Bay, and southern coast of New Guinea (Fig. 84).

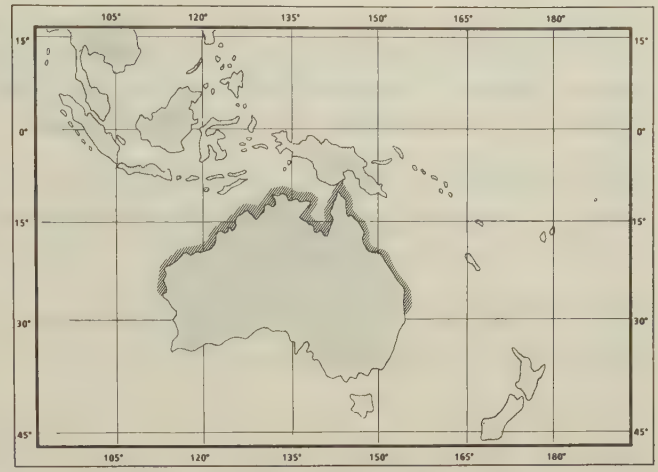


Fig. 84

Habitat and Biology: Usually found between 0 and 10 m depths. Spawning takes place from September to January. Lenanton (1969a; 1969b) described the Shark Bay, Western Australian fishery and records that the juveniles of this species, together with those of *S. schomburgkii*, "remain in the warmer waters of the shallow mangrove creek shorelines and protected inlets. On reaching maturity *Sillago analis* prefer the muddy, tidal streams but *Sillago schomburgkii* are located on the more open, sandy banks." Brewer and Warburton (1992) found that the preferred prey of *S. analis* are crustaceans. It also grubs in the silty-sand substrates for worms and has been observed to "plough" up the bottom with the snout.

Size: To 45 cm standard length.

Interest to Fisheries: An important fishery based on this species and others has developed in Shark Bay and to a lesser extent in Queensland. The juveniles enter mangrove creeks and may be future candidates for estuarine aquaculture.

Local Names: AUSTRALIA: golden lined whiting, Tin Can Bay whiting (Queensland), Rough-scale whiting (Western Australia).

Literature: Whitley (1948:19, Western Australia, 1954:27, Melville Island, 1964:43); Haysom (1957:141 recorded Queensland); Grant (1965:85, Tin Can Bay, 1972:244, biology); Weng (1983, 1986); McKay (1985:18-19, figs 3B, 9A-D); Brewer and Warburton (1988:215-217, dietary variation); Allen and Swainston (1988: col. pl. 354).

Remarks: *Sillago nierstraszi* is almost certainly a senior synonym of *S. analis*. The holotype of *S. nierstraszi* was unavailable for study by McKay (1985). Further collecting in southern New Guinea is necessary to resolve the identity of *S. nierstraszi*.

Sillago arabica McKay and McCarthy, 1989 Fig. 85 SILL Sill 7

Sillago arabica McKay and McCarthy, 1989:551-552, figs 1, 2A, 3A-C (Arabian Gulf).

Synonyms: None.

FAO Names: **En** - Arabian sillago; **Fr** - Pêche-madame arabe; **Sp** - Silago arabe.

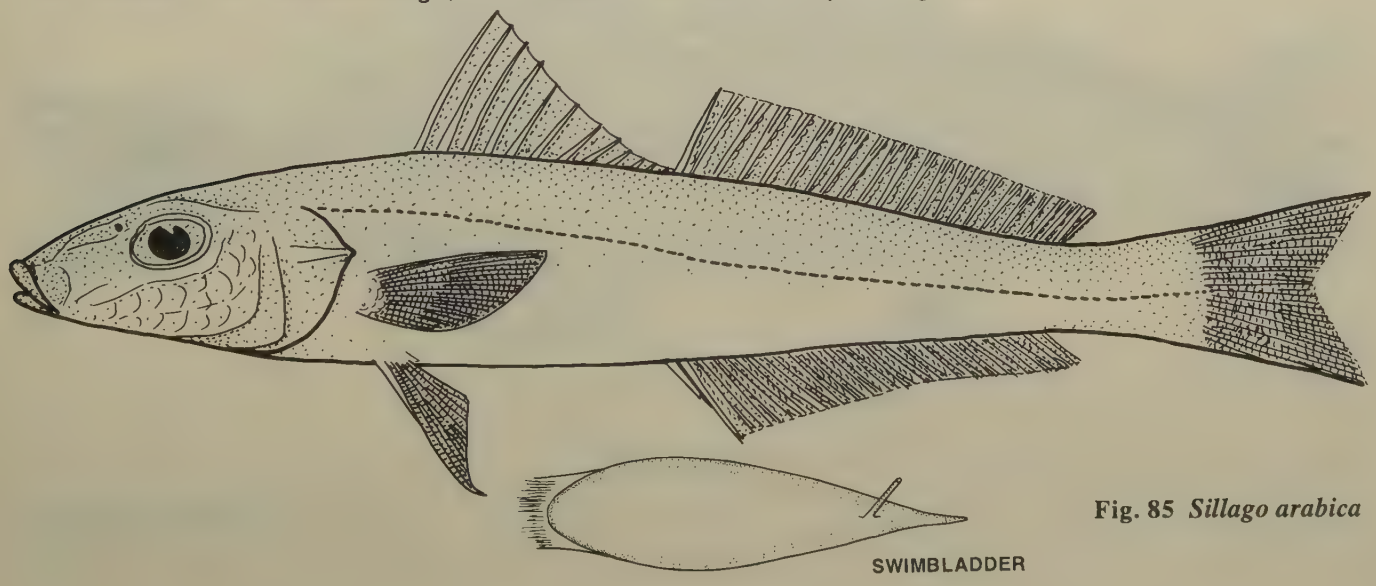


Fig. 85 *Sillago arabica*

Diagnostic Features: First dorsal fin with XII or XIII spines and second dorsal fin with I spine and 22 to 24 soft rays; anal fin with II spines and 22 to 24 soft rays. Lateral-line scales 75 to 80; cheek scales in 3 or 4 rows, all ctenoid. Vertebrae: 15 or 16 abdominal + 0 or 1 modified + 22 to 25 caudal, 38 to 40 total. Swimbladder without anterior extensions and with a single posterior extension. **Colour**: No irregular dark blotches on sides.

Geographical Distribution: Arabian Gulf (Fig. 86).

Habitat and Biology: Shallow coastal waters of the Arabian Gulf, down toa depth of 5 m.

Size: Maximum size known 15 cm total length.

Interest to Fisheries: None at present.

Local Names:

Remarks: McKay and McCarthy proposed the common name shortnose whiting as the snout in this species is 31 to 38% (mostly 33 to 35%) of head length and this character may assist recognition of this species in the field.

Fig. 86

Sillago argentifasciata Martin and Montalban, 1935 | Fig. 87 | SILL Sill 8

Sillago argentifasciata Martin and Montalban, 1935:226-227, pl. 1, fig. 3 (Lumbucan Island, Palawan, Philippines).

Synonyms: None.

FAO Names: **En** - Silver-banded sillago; **Fr** - Pêche-madame ceinture d'or; **Sp** - Silago de bandas plateadas.

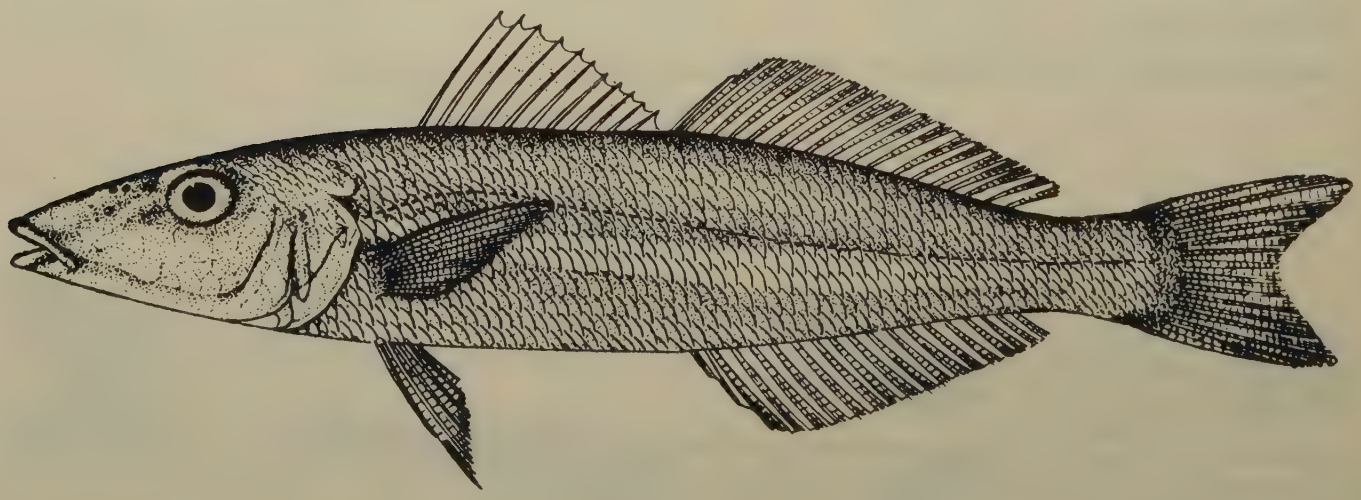


Fig. 87 ***Sillago argentifasciata***
(from Martin and Montalban, 1935)

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 17 or 18 soft rays; anal fin with II spines and 17 soft rays. Lateral-line scales 66; cheek with three rows of scales, those on the upper row cycloid, and on the lower two rows ctenoid. **Colour**: No irregular dark blotches on sides; a wide, brilliant, silvery stripe on each side of the body.

Geographical Distribution: Lumbucan Island, Palawan, Philippines (Fig. 88).

Habitat and Biology: Unknown.

Size: Not known.

Interest to Fisheries: None.

Local Names:

Literature: Herre (1953:478); McKay (1985:40, fig. 5A).

Remarks: *Sillago argentifasciata* was not included in the large amount of material examined from the Philippines by McKay (1985). The type specimens were destroyed during the Second World War and further collecting at the type locality and the designation of a neotype is necessary to resolve the identity of this species. This species is similar to *Sillago ingenuua* and may prove to be a senior synonym; see also remarks under *Sillago ingenuua*.

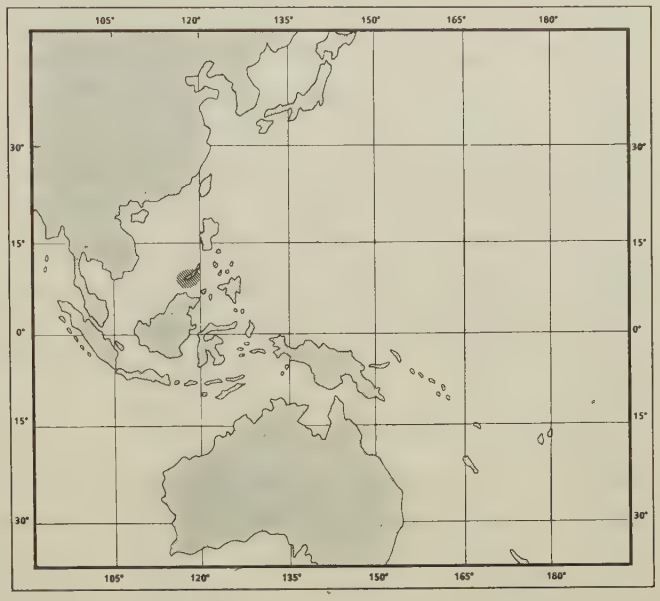


Fig. 88

Sillago asiatica McKay, 1983 | Fig. 89 | SILL Sill 9

Sillago asiatica McKay, 1983:613-614.

Synonyms: None.

FAO Names: **En** - Asian sillago; **Fr** - Pêche-madame asiate; **Sp** - Silago asiatico.

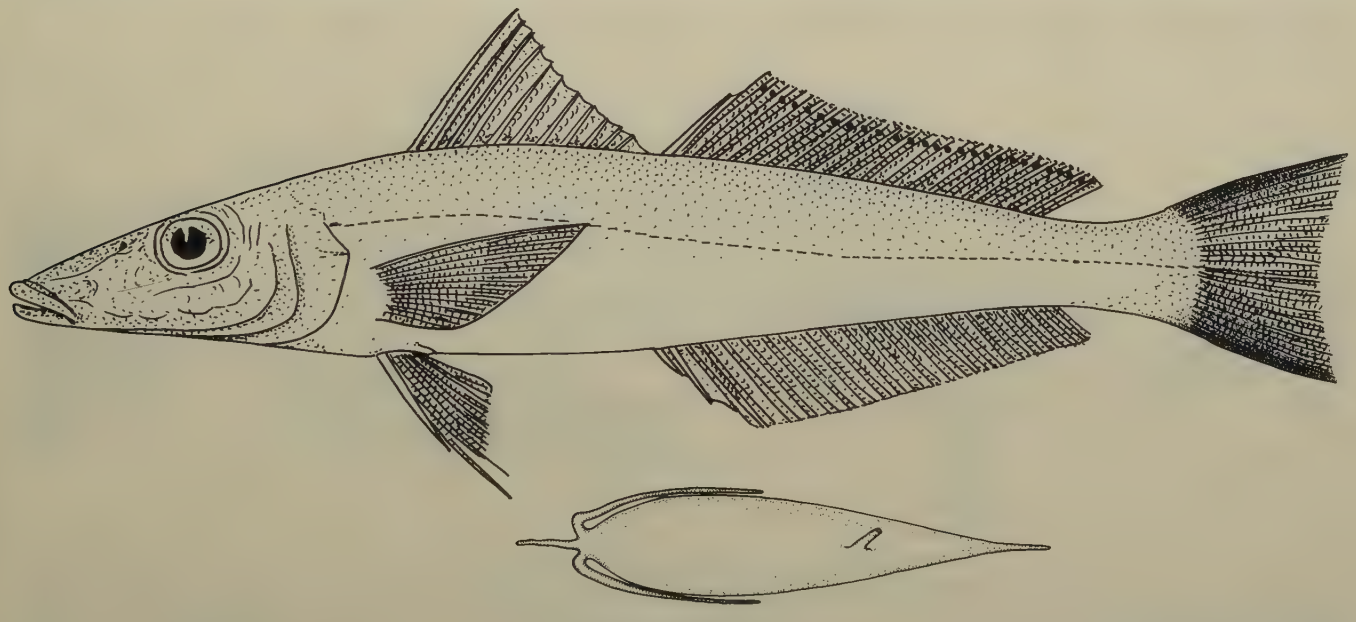


Fig. 89 *Sillago asiatica*

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 20 or 21 soft rays; anal fin with II spines and 21 to 23 soft rays. Lateral-line scales 67 to 70. Vertebrae: 13 or 14 abdominal + 5 to 7 modified + 13 to 16 caudal, 34 total. Swimbladder with three anterior extensions, the middle one projecting forward and the anterolateral ones recurved backward along the swimbladder; a single posterior extension. **Colour**: Head and body pale sandy brown to light fawn, an indistinct pale mid-lateral stripe is present on some specimens; belly paler, almost white; opercle and preopercle transparent with a crescentic patch of fine black-brown spots in a pigmented area the shape of the gill arches on the inside of the gill cover, showing through. Fins hyaline, the margins of the unpaired fins finely spotted with brown; the upper and lower margins of the caudal fin dark brown to almost black.

Geographical Distribution: From the Gulf of Thailand to Taiwan. This species is possibly widespread (Fig. 90).

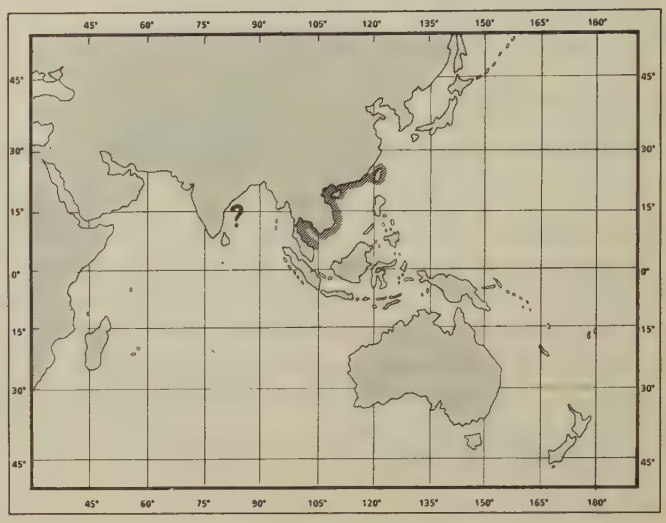


Fig. 90

Habitat and Biology: Widely distributed in Taiwan and previously confused with *S. sihama*, this species appears to be more abundant than the latter species at Kaohsiung, Taiwan (Shao et al., 1986). It inhabits depths from 10 to 50 m.

Size: To 15 cm standard length.

Interest to Fisheries: Utilised fresh throughout its range. A small but important fishery exists in Taiwan.

Local Names:

Remarks: *Sillago soringa* Dutt and Sujatha is almost certainly a senior synonym of *S. asiatica* but it is reported to differ in having the swimbladder with shorter recurved extensions and the postcoelomic part of the swimbladder relatively shorter. Shao et al. (1986) found the recurved extensions of the swimbladder to be 1/4 to 1/5 of the swimbladder length.

Sillago attenuata McKay, 1985 | Fig. 91 | SILL Sill 10

Sillago attenuata McKay, 1985:36, figs 12A, 13C, 16 (Arabian Gulf).

Synonyms: None.

FAO Names: **En** - Slender sillago; **Fr** - Pêche-madame élégant; **Sp** - Silago magro.

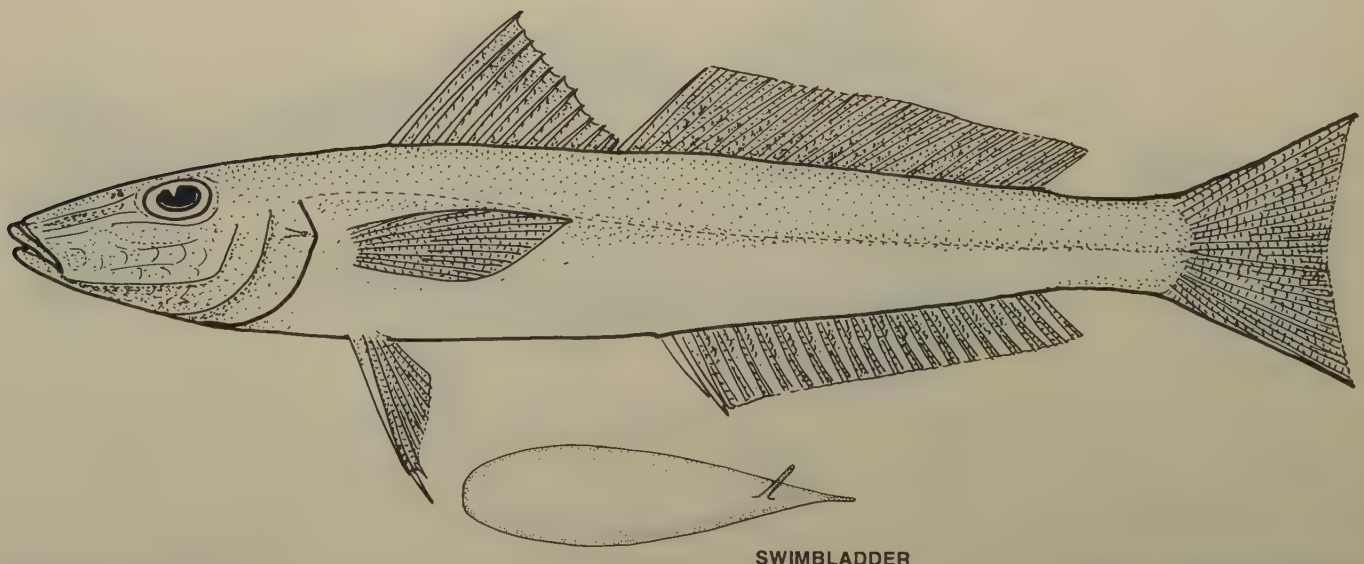


Fig. 91 *Sillago attenuata*

Diagnostic Features: First dorsal fin with XII or XIII spines and second dorsal fin with I spine and 19 to 21 soft rays; anal fin with II spines and 18 to 20 soft rays. Lateral-line scales 73 to 77. Vertebrae total 37 to 39. **Colour**: Body with faint blotches in two series laterally, the upper row of about 8 or 9 spots, the lower mid-lateral row with 10 spots; a row of indistinct spots or blotches along the base of the spinous dorsal fin; first dorsal fin with the anterior most interspinous membranes dusted with black spots; membrane of the second dorsal fin dusted black, other fins hyaline. Juveniles with a well defined mid-lateral horizontal row of 9 elongate spots on body just below lateral line; between the lateral line and the base of the dorsal fins is a horizontal row of about 12 small spots ending before the last ray of the dorsal fin; a longitudinal row of very small spots along centre of back, 2 spots before dorsal fin, 4 spots below fin and on caudal peduncle.

Geographical Distribution: Arabian Gulf (Fig. 92).

Habitat and Biology: Shallow coastal waters of the Arabian Gulf.

Size: To at least 20 cm standard length.

Interest to Fisheries: Taken by beach seine and utilised fresh.

Local Names:

Literature: McKay and McCarthy (1989, figs 2B, 3D).

Remarks: The swimbladder is almost transparent in juveniles.

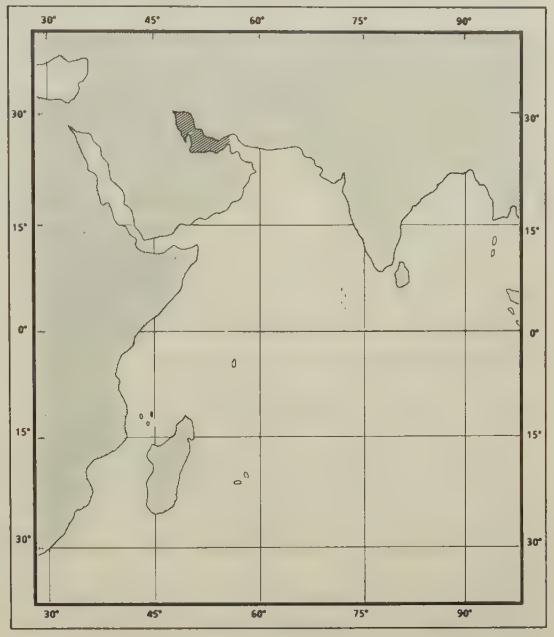


Fig. 92

Sillago bassensis Cuvier, 1829 | Fig. 93 | SILL Sill 11

Sillago bassensis Cuvier in Cuvier and Valenciennes, 1829:412 (Port Western, Bass Strait, Victoria).

Synonyms: *Sillago* (*Parasillago*) *bassensis bassensis*: McKay, 1985:28-29, figs 4A, 13U-V, 14J, 15.

FAO Names: **En** - Western school sillago; **Fr** - Pêche-madame transparent; **Sp** - Silago occidental.

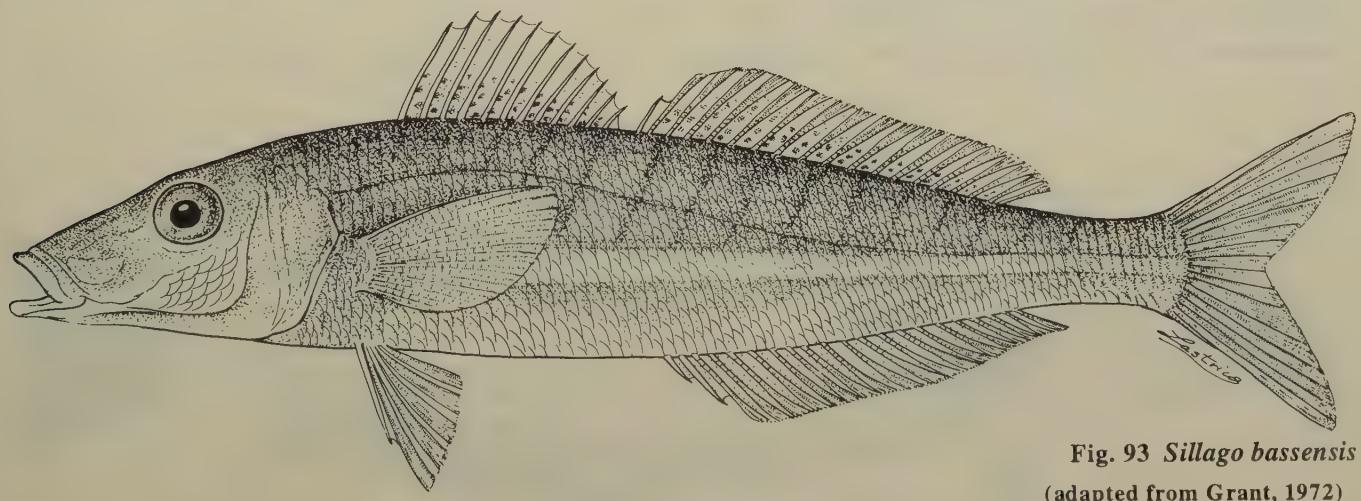


Fig. 93 ***Sillago bassensis***
(adapted from Grant, 1972)

Diagnostic Features: First dorsal fin with X to XII spines and second dorsal fin with I spine and 18 or 19 soft rays; anal fin with II spines and 18 to 20 soft rays. Lateral-line scales 66 to 73. Vertebrae: 12 to 14 abdominal + 12 to 14 modified + 7 to 9 caudal, total 33 to 35. The swimbladder is very similar to that of *S. flindersi*. **Colour**: No dark spot at the base of the pectoral fin; a series of oblique broken rusty brown bars on the back and upper sides, without a longitudinal row of rusty brown blotches along the midlateral silver stripe.

Geographical Distribution: Geraldton area, Western Australia southward and along the southern coast to South Australia and western Victoria; not yet recorded from western Tasmania (Fig. 94).

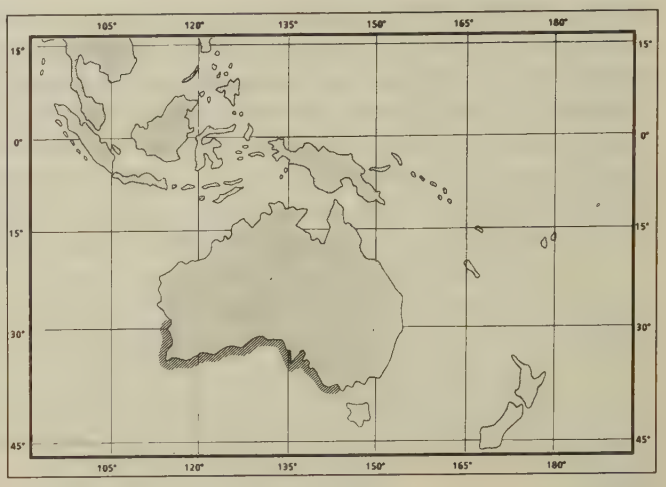


Fig. 94

Habitat and Biology: Common along the lower Western Australian coastline, and bays of South Australia. Frequenting the surf zone of beaches and quiet waters of bays and sandbanks, this species is also trawled in offshore waters to at least 55 m and possibly much deeper. Juveniles may be found in a few centimetres of water off white sand beaches in association with accumulations of dead seaweed in the surf zone of southwestern Australian waters, but are not recorded from estuarine waters as are the juveniles of ***Sillaginodes punctata***, ***Sillago schomburgkii***, and ***Sillago burrus***. The western school whiting is reported to move into shallow waters in large schools during the full moon. It may have luminescent bacteria when left out of water.

Size: To 33 cm standard length.

Interest to Fisheries: A local bottom trawl fishery is present seasonally in Western Australia, and this species is caught largely as a bycatch.

Local Names: AUSTRALIA: Western school whiting, Trawl whiting.

Literature: Quoy and Gaimard (1834:672-673, pl. 1, fig. 2); McCulloch (1911:61, part); Fowler (1933:422-423, part); Whitley (1948:19, 1964:43); Roughley (1951:48-49, part); Scott (1962:187, South Australia); Hutchins and Swainston (1986:col. pl. 264).

Remarks: McKay (1985) treated this species as a subspecies (see ***S. flindersi***). He followed Cuvier (1829:412) in regarding the type locality as Western Port, Victoria. As the holotype has the locality recorded as "Port du Roi Georges" (= King George Sound, Western Australia), the latter locality is possibly correct.

Sillago boutani Pellegrin, 1905	Fig. 95	SILL Sill 12

Sillago boutani Pellegrin, 1905:86 (Baie de Hatan, Along, North Vietnam).

Synonyms: ***Sillago* (?*Parasillago*) *boutani***: McKay, 1985:34-36.

FAO Names: **En** - Boutan's sillago; **Fr** - Pêche-madame pagus; **Sp** - Silago de Boutan.

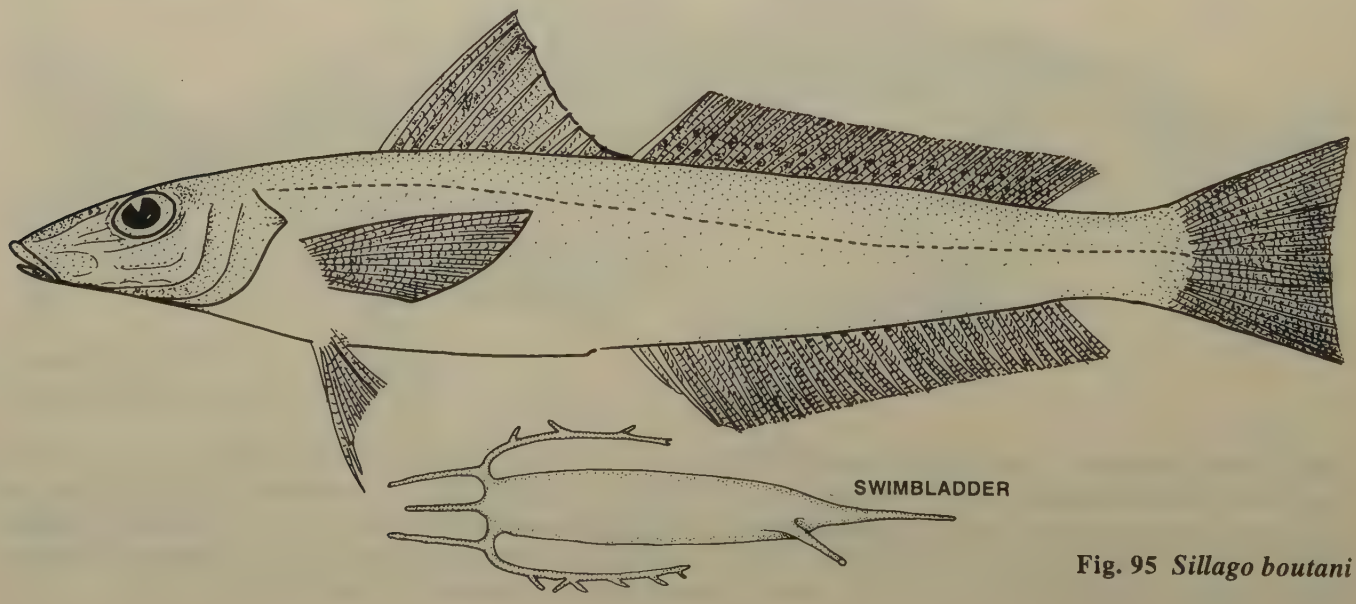


Fig. 95 *Sillago boutani*

Diagnostic Features: First dorsal fin with XI spines (last spine very short) and second dorsal fin with I spine and 21 soft rays; anal fin with II spines and 21 or 22 soft rays. Lateral-line scales 76 to 80. Vertebrae: 13 or 14 abdominal + 3 or 4 modified + 21 caudal, elongate with a total of 38. **Colour**: Body olive-yellow dorsally, paler on the sides and abdomen; cheeks and part of operculum orange-yellow; one or two stripes of orange-yellow run along the sides of the body; fin uniformly greyish, with some indication of dots on the rays of the second dorsal fin.

Geographical Distribution: Gulf of Tongking, and China (Fig. 96).

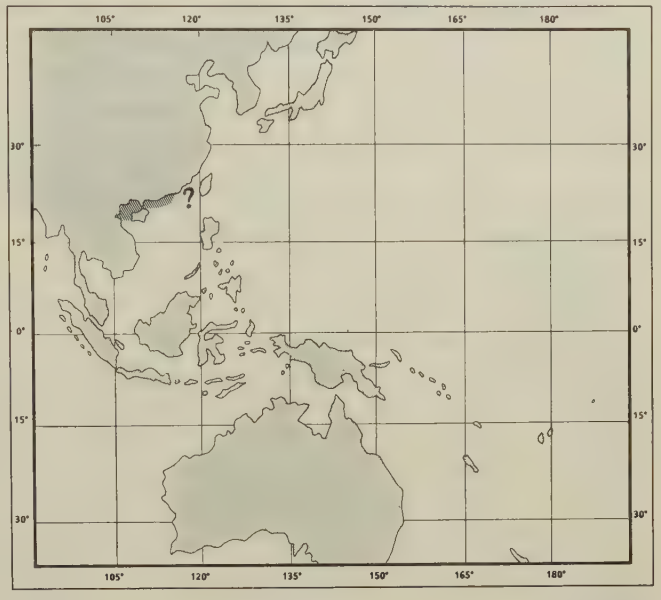


Fig. 96

Habitat and Biology: An inshore species on silty bottoms, in depths down to 20 m.

Size: To 20 cm standard length.

Interest to Fisheries: Reported to be taken by seine net in Vietnam and forms the basis of an export market in butterflied fillets to Japan. The sillaginids of the Gulf of Tongking are inadequately known.

Local Names:

Literature: Fowler (1933:421-422).

Remarks: This species is rare in collections, and may be misidentified as *Sillago sihama*. The swimbladder has a single posterior extension.

Sillago burrus Richardson, 1842 | Fig. 97 | SILL Sill 13

Sillago burrus Richardson, 1842:128-130 (Northwest Australia).

Synonyms: *Sillago maculata burra*: Whitley, 1948:19; *Sillago* (*Parasillago*) *maculata burrus*: McKay, 1985:24-26. *Sillago maculata*: Paradice and Whitley, 1927:89; Taylor, 1964:174-175.

FAO Names: **En** - Western trumpeter sillago; **Fr** - Pêche-madame clairon; **Sp** - Silago tromperero occidental.

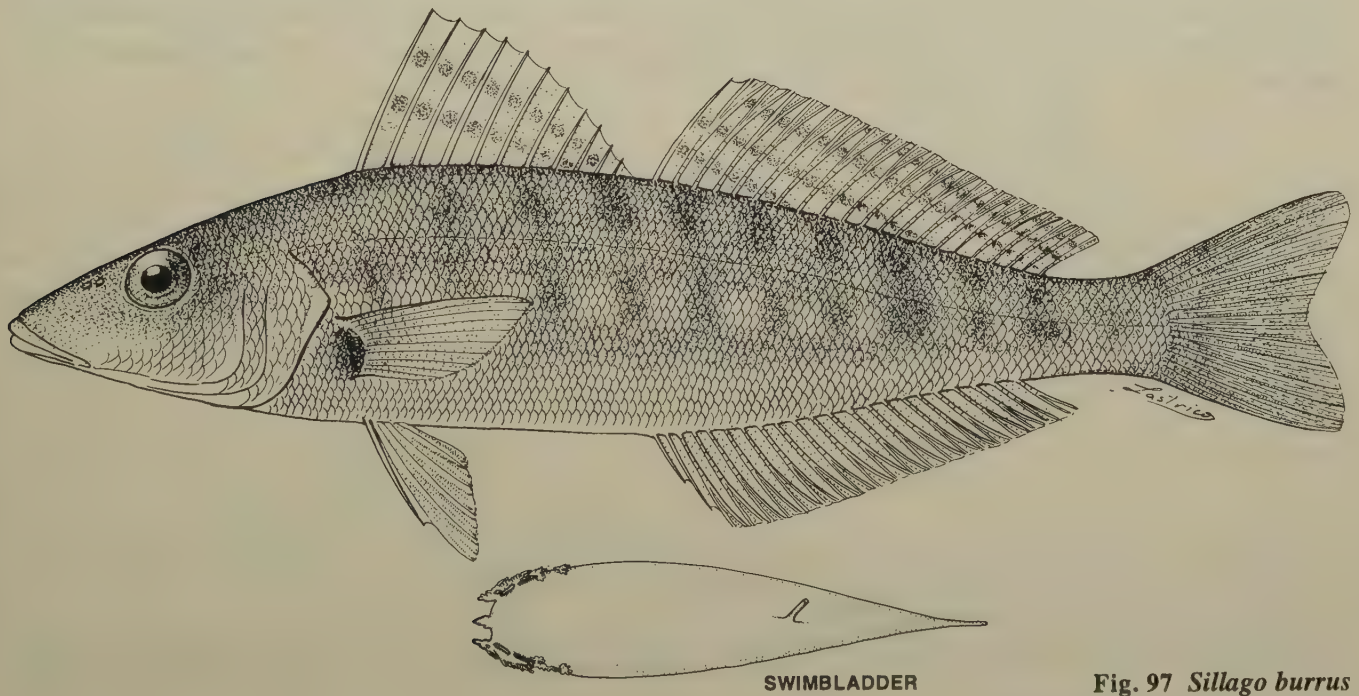


Fig. 97 *Sillago burrus*
(adapted from Richardson, 1843)

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 19 to 21 soft rays; anal fin with II spines and 18 to 20 (rarely 18) soft rays. Lateral-line scales 69 to 76. Vertebrae: 13 or 14 abdominal + 20 to 22 caudal, total of 34 to 36 (rarely 34). The swimbladder has four anterolateral extensions that are more complex than *S. aeolus*, but much shorter than *S. maculata*. **Colour**: *S. burrus* is very similar in coloration to *S. aeolus* and *S. maculata*. In *S. burrus* the blotches are like oblique bars and they are not joined as in *S. maculata*. The upper blotches are small, the black spot at the base of the pectoral fin is indistinct and the belly is silvery. The lateral silvery stripe is usually noticeable but may be quite faded. Inside of opercle white whereas *S. maculata* has an inner dark blotch showing through. The upper and lower margins of the caudal fin are not as dark as in *S. maculata* and the abdominal walls are usually white or silvery whereas they are pale flesh coloured in the latter species.

Geographical Distribution: Northern coast of Australia, southern New Guinea, and Indonesia (Fig. 98).

Fig. 98

Habitat and Biology: *Sillago burrus* is most abundant on silty-sand or muddy substrates, the large adults feeding near gutters and sandbars inside Shark Bay and may also be found on mostly sandy bottoms. The juveniles frequent seaweed banks and broken bottom, and occur in large numbers near mangrove creeks. They enter the coastal rivers in the Swan and Mandurah estuaries in Western Australia throughout the summer months where they are netted by prawn fishermen operating in shallow weedy areas. Adults move into deeper waters of marine embayments. Juveniles and adults are commonly trawled in association with the western population of *Sillago robusta*, and *Sillago lutea* in depths to 36 m.

Size: To 36 cm standard length.

Interest to Fisheries: Mostly taken by trawl net in depths from a few metres to at least 36 m, and are generally part of the bycatch of shrimp trawlers. Marketed fresh in Australia.

Local Names: AUSTRALIA: Western trumpeter whiting.

Literature: Richardson (1843, pl. 2, fig. 1); Castelnau (1878:232); Hutchins and Swainston (1986:col. pl. 267a); Allen and Swainston (1988:col. pl. 356).

Remarks: Frequently confused with *Sillago maculata*. McKay (1985) treated this species as a subspecies of *Sillago maculata* since no specimens had been collected east of Torres Straits. Specimens of *S. burrus* have recently been captured by trawl net east of Cairns and southeast of Hinchinbrook Island, Queensland in 32 m. The taxon is therefore elevated to full specific status in this work.

Sillago chondropus Bleeker, 1849 | Fig. 99 | SILL Sill 3

Sillago chondropus Bleeker, 1849a:61 (Batavia).

Synonyms: *Sillago* (*Sillaginopodys*) *chondropus*: McKay, 1985:5-6, figs 1B, 2A, 8B, 17; Shao et al., 1986:143-144.

FAO Names: **En** - Clubfoot sillago; **Fr** - Pêche-madame diablotin; **Sp** - Silago pateta.

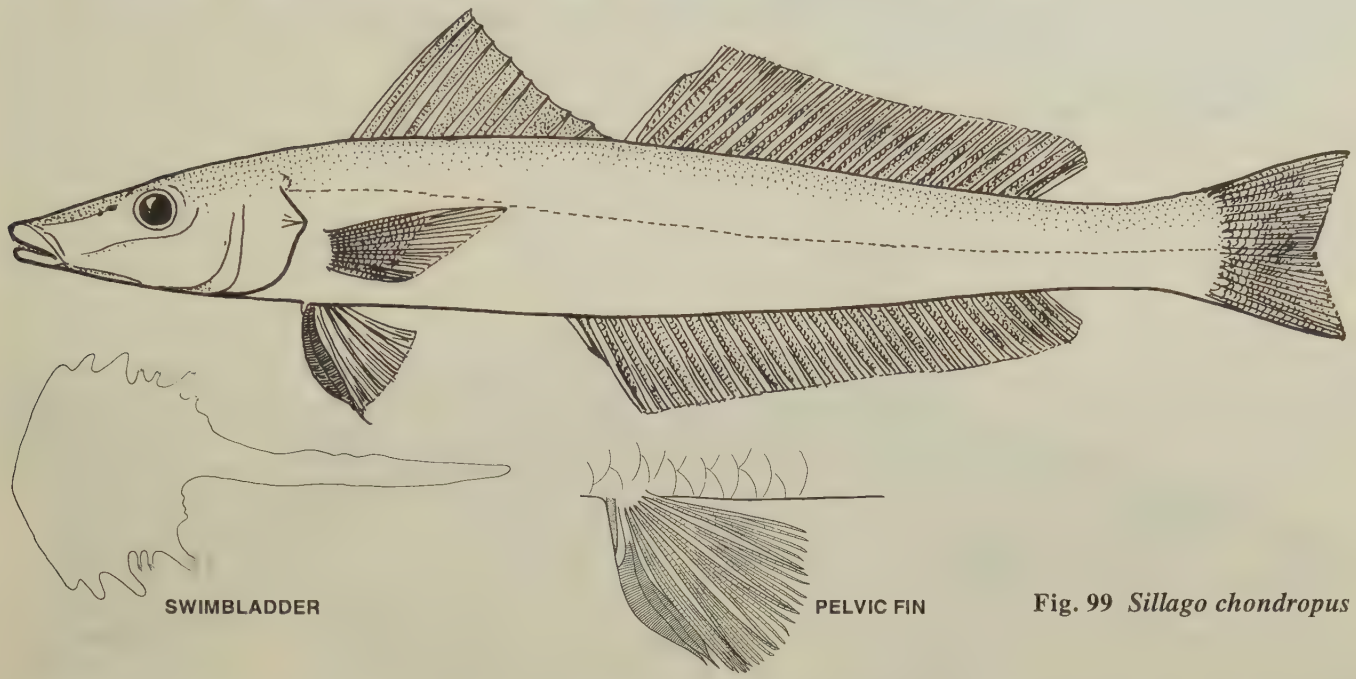


Fig. 99 *Sillago chondropus*

Diagnostic Features: First ray of pelvic fin modified into a laterally compressed thickened club-like structure; first dorsal fin with XI to XII spines (last spine very short) and second dorsal fin with I spine and 20 or 21 soft rays; anal fin with II spines and 22 or 23 soft rays. Lateral-line scales 66 to 73. Vertebrae: 12 or 13 abdominal + 22 or 23 caudal, total of 35. Swimbladder reduced in size, no duct-like process from the ventral surface to the urogenital aperture.

Geographical Distribution: South Africa, northward to Pakistan, India, Burma, Indonesia, northern New Guinea, Thailand, Philippines and Taiwan (Fig. 100). Not recorded from southern New Guinea or Australia.

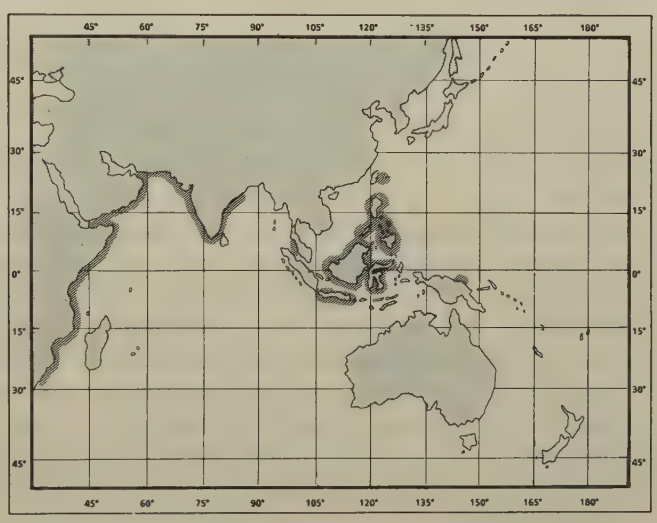


Fig. 100

Habitat and Biology: Shallow coastal waters, from 0 to 5 m depths. In eastern Taiwan blackish substrates with strong current and wave action are inhabited (Shao et al., 1986). The reduced swimbladder and modified pelvic fin indicates that this species is demersal and may use the pelvic fin pads somewhat like sled runners on the bottom.

Size: To 35 cm standard length.

Interest to Fisheries: Captured by seine and marketed fresh.

Local Names: SOUTH AFRICA: Horrelvoet sillago.

Literature: Bleeker (1849:5, 8, 10, New Guinea, 1874:65, 1877, pl. 389, fig. 2); Günther (1860:246, Mollucca Sea); Gill (1861:504); Gilchrist and Thompson (1908:193, Natal, 1917:348); Regan (1908:245); Barnard (1927:508, Natal); Weber and de Beaufort (1931:176, fig. 34); Fowler (1933:430-431, 1949b:96); Herre (1939:112, Burma, 1953:478, many records); Smith (1949:204, fig. 469, South Africa, rare); Palekar and Bal (1955:128, description); Munro (1958:178, New Guinea, 1967:346); Dutt and Sujatha (1980:372); McKay (1980:382-383, 1986:615).

Sillago ciliata Cuvier, 1829 | Fig. 101 | SILL Sill 14

Sillago ciliata Cuvier in Cuvier and Valenciennes, 1829:415 (Southern Seas).

Synonyms: ***Sillago diadoi*** Thiollière, 1857:151 (Woodlark Island, Papua). ***Sillago insularis*** Castelnau, 1873:232 (Noumea, New Caledonia). ***Sillago terra-reginae*** Castelnau, 1878:232 (Moreton Bay, Queensland). ***Sillago bassensis*** (non ***Sillago bassensis*** Cuvier): Castelnau, 1879:381; Macleay, 1881:567; Kent, 1893:291; Tosh, 1902:175-184 (behaviour, eggs, postlarvae, growth). ***Sillago ciliata diadoi***: Whitley, 1932a:344-345. ***Sillago gracilis*** (non ***Sillago gracilis*** Alleyne and Macleay): Whitley, 1932b:284

FAO Names: **En** - Sand sillago; **Fr** - Pêche-madame sable; **Sp** - Silago arena.

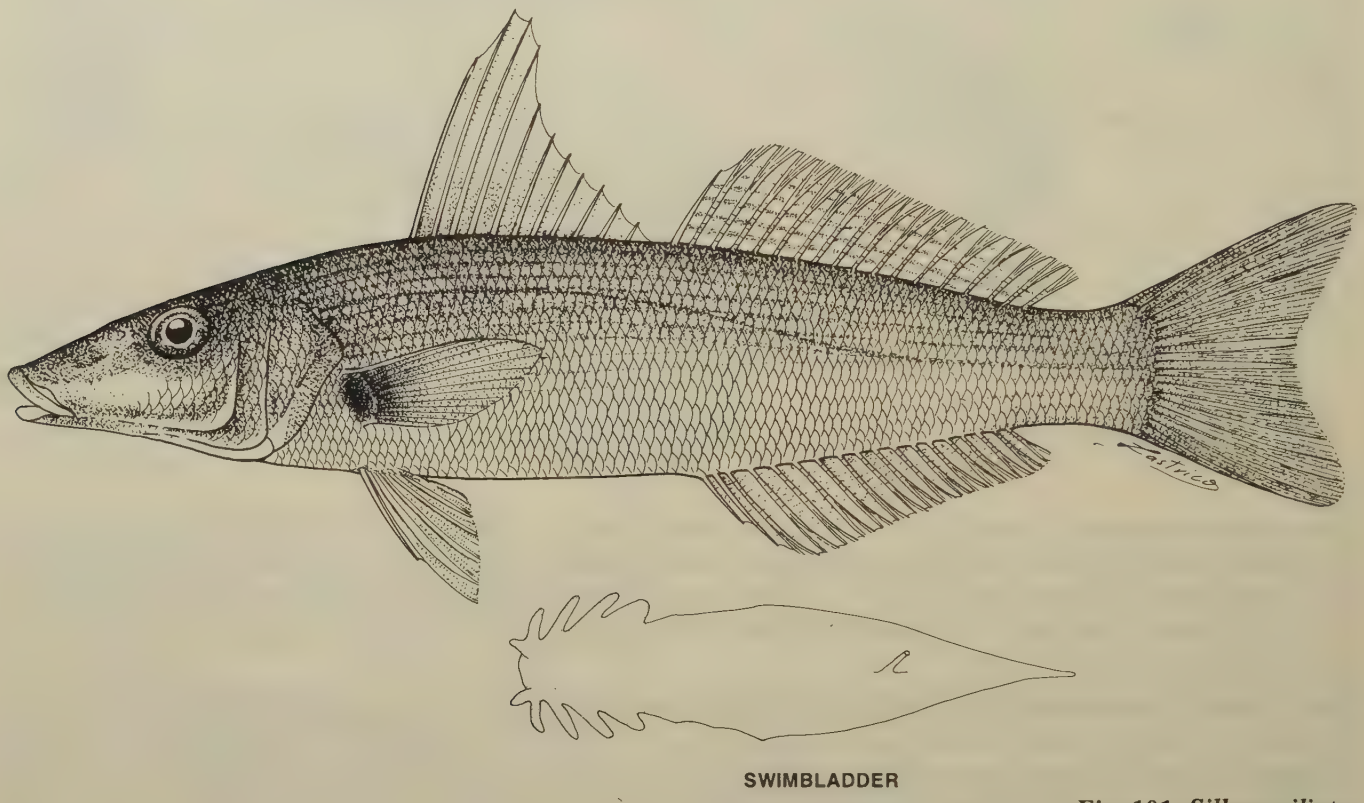


Fig. 101 ***Sillago ciliata***
(adapted from Grant, 1972)

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 16 to 18 soft rays; anal fin with II spines and 15 to 17 soft rays. Lateral-line scales 60 to 69. Vertebrae: 14 or 15 abdominal + 5 to 8 modified + 11 to 14 caudal, total of 32 to 34. Anterior part of the swimbladder with rudimentary tubules projecting anteriorly and a series laterally that diminish in size and become sawtooth-like posteriorly; the shape of the swimbladder is not distinguishable from ***Sillago analis***. **Colour**: A dark spot at the base of the pectoral fin; coloration of adult specimens uniform without darker bars or blotches.

Geographical Distribution: East coast of Australia from Cape York, Queensland (rare), southward along the coast and the Great Barrier Reef to eastern Victoria, and the east coast of Tasmania. Lord Howe Island, New Caledonia, and Woodlark Island, Papua New Guinea (Fig. 102). Bleeker's (1845, 1849) records from Batavia and Java were in error (Weber and de Beaufort, 1931:178).

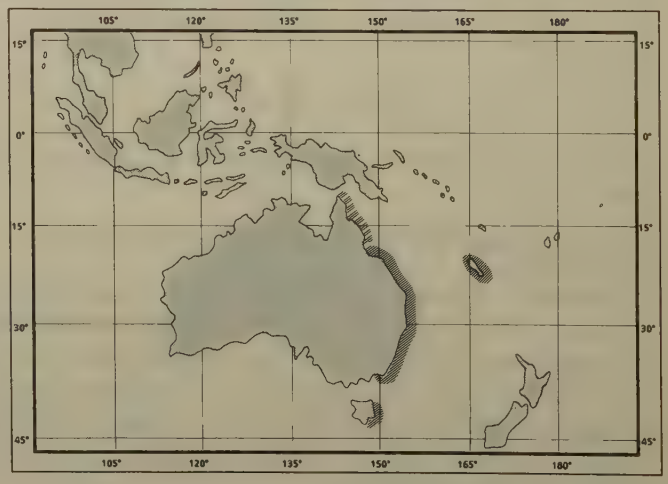


Fig. 102

Habitat and Biology: *Sillago ciliata* is an onshore species occurring on coastal beaches, sandbars and surf zones as well as open bays, estuaries and coastal lakes; occasional specimens have been taken in offshore waters to 40 m during winter. Sand whiting enter estuaries and penetrate far upstream to the tidal limits of rivers and creeks where juveniles and adolescent fish may be abundant. The adults congregate around the mouths of estuaries, bars, and spits, in depths down to 5 m. Tosh (1902) described the egg and larval development and gives the spawning period as September to February. Burchmore et al. (1988) reported peak reproductive condition in February, with high levels in December. Tosh also describes the habits of this species and mentions "Soon after the beginning of the spawning season young whiting of 10 mm and over can be observed swimming actively in small droves of from 10 to 20 on sand flats and beaches. They move up and down with the tide, swimming in very shallow water. As they grow older they keep further from the shore. The whiting may be said to live almost exclusively on sandy ground. The adults appear to be gregarious only at spawning time." Dredge (1976) found juveniles inhabited shallow areas with some seagrass. Burchmore et al. (1988) proposed that the *Zostera* areas are important habitats for juveniles of this species in Botany Bay. Morton (1985) found that recaptured tagged *S. ciliata* were taken within 15 km of their release site during the spawning season. *S. ciliata* feeds mostly on polychaetes (61%) and crustaceans (37%) in Botany Bay (Burchmore et al., 1988).

Size: To 51 cm total length.

Interest to Fisheries: A very important commercial species and an esteemed angling fish weighing up to 1.25 kg. In southeast Queensland the fishery operates from August to February when schools form, presumably to spawn, as most fish are in a spawning or near spawning condition (Dredge, 1976; Morton, 1982). Beach seines and tunnel-nets are employed by commercial fishermen. The fish are marketed fresh. Research is underway on aquaculture for this species.

Local Names: AUSTRALIA: Sand whiting, Bluenose whiting, Summer whiting.

Literature: Valenciennes (1839:13, fig. 2); Günther (1860:245, 1880:42, Cape York); Jouan (1861:272, New Caledonia); Gill (1862a:504); Kner (1865:127-128); Steindachner (1866:443-444); Schmeltz (1869:16, 1879:44); Castelnau (1875:16); Alleyne and Macleay (1877:279, Cape York, abundant); Klunzinger (1879:369, description); Macleay (1881:202); Tenison-Woods (1882:65, pl. 24); Ogilby (1886:31); McCoy (1890:229, pl. 182, Victoria, rare); Cohen (1892:17); Kent (1893:292, 370, pl. 45, fig. 2); Waite (1901:47, 1904:206, Lord Howe Is.); Stead (1906a:574-576, distinguished from *S. flindersi*, 1908b:63, pl. 33); McCulloch (1911:62, references), 1921:60, sandy bottoms, 1927:50); Cockerell (1915:41-42, scale, 45 cm, 22 years); Fowler (1928a:253, 1933:428-430, 1953:15); Starks (1926:253, osteology, ethmoid region); Weber and de Beaufort (1931:171, 178); Whitley (1932a:344-345, 1955:331, 51 cm, 1964:43); Hardenberg (1941:228, *S. analis*?); Cleland (1947:215-228, biology, fishery); Roughley (1951:46-48, pl. 15, biology); Legand (1952, growth, New Caledonia); Munro (1945, larvae, 1958:178, New Guinea, 1967:346, New Guinea); Parrott (1959:201, eggs float); Woodland and Slack-Smith (1963:32, Heron Island); Marshall (1964:170, biology); Grant (1965:84, 1972:243); Lanzing (1967:242, saccus vasculosus); Lanzing and Hynd (1967:177-178, age, OTC); Dredge (1976, biology); Weng (1983, juveniles, 1986, spatial distribution); McKay (1985:15-17, figs); Morton (1985a, reproduction, 1985b:19-23, tagging); Hutchins and Swainston (1986:col. pl. 268); Goodall et al. (1987, gonads); Burchmore et al. (1988, biology); Goodall et al. (1989, spermatozoa).

Remarks: *Sillago ciliata* and *Sillago analis* are sibling species that can be separated by colour and in most cases, lateral-line scale counts.

Sillago flindersi McKay, 1985 | Fig. 103 | SILL Sill 15

Sillago (*Parasillago*) *bassensis flindersi* McKay, 1985:29-30, figs 91-L, 14K, 15 (New South Wales).

Synonyms: *Sillago bassensis*: Cohen, 1892:17; Stead, 1906a:574-576, 1906b:111, 1908b:65, pl. 35; McCulloch, 1911:61 (part), 1921:61, pl. 21; Fowler, 1933:422-423 (part); Roughley, 1951:48-49 (part, offshore fishery); Parrott, 1959:201; Scott, 1962;187; Marshall, 1964:170; Whitley, 1964:43; Grant, 1965:87, 1972:247; Last et al., 1983:357-358 (Tasmania). *Sillago maculata* (non *Sillago maculata* Quoy and Gaimard): Castelnau, 1872:94; Waite, 1899:109 (29-151 m, spawning?). *Sillago ciliata* (non *Sillago ciliata* Cuvier): Johnston, 1883:80, 116, 1891:25, 33.

FAO Names: **En** - Flinders' sillago; **Fr** - Pêche-madame peren; **Sp** -Silago de Flinders.

Fig. 103 *Sillago flindersi*
(adapted from Hutchins and Swainston, 1986)

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 16 to 18 soft rays; anal fin with II spines and 18 to 20 soft rays. Lateral-line scales 65 to 69. Vertebrae: 13 abdominal + 9 to 11 modified + 9 to 11 caudal, total of 32 to 34. **Colour**: No dark spot at the base of the pectoral fin; a series of oblique rusty brown bars on back and upper sides, with a longitudinal row of rusty brown blotches along the midlateral silver stripe; coloration is very similar to *S. bassensis* but the oblique bars are wider, more regular and without the appearance of fused dots or spots; the midlateral blotches are absent in *S. bassensis*.

Geographical Distribution: Southern Queensland southward to Anxious Bay, South Australia, and the east coast of Tasmania (Fig. 104).

Fig. 104

Habitat and Biology: An offshore species not known in southern Queensland until the development of offshore prawn trawling (Grant, 1965). The adults move offshore and are taken by bottom trawl to depths of 180 m. Juveniles congregate in shallow water where they may be taken by line in large quantities. They are not reported from estuarine waters. Within Botany Bay the juveniles consume mostly copepods and the larger fish (11 to 20 cm) eat mainly *Callianassa* and amphipods. The overall diet is mostly crustaceans (75%), principally amphipods (18%), decapods (18%), mysidaceans (15%) and copepods (13%). Polychaetes make up only 14% of the total diet (Burchmore et al., 1988). This species spawns during October to March in southern New South Wales, but spawns in winter in southeast Queensland and northern New South Wales.

Size: To 33 cm standard length.

Interest to Fisheries: An important export market has developed for this species (Table 3). Danish seine vessels working in eastern Victoria and southeastern Tasmania obtain large catches. This species is an important bycatch of the prawn trawlers operating in northern New South Wales. The grounds off Lakes Entrance, Victoria, and Iluka, northern New South Wales have produced the bulk of the catch exported frozen to Japan in recent years. In 1985 to 86 the value of exports exceeded $A 2.5 million (Dixon et al., 1987).

Local Names: AUSTRALIA: Eastern school whiting, Bass Strait whiting, Spotted whiting, Redspot whiting.

Literature: Hutchins and Swainston (1986:col. pl. 265).

Remarks: McKay (1985) described this species as a subspecies of *S. bassensis* since, at that time, the two populations were known from allopatric populations. Further collecting in Bass Strait showed the species to overlap in distribution, and electrophoresis conducted by Dixon et al. (1987) confirmed that the two populations were valid species as McKay (1985) had suggested.

Table 3: Australian sillago exports of *S. flindersi* for years 1980-1986.

Year	Tonnes	Value $A
1980-81	777	878,000
1981-82	1,499	1,855,000
1982-83	1,253	1,763,000
1983-84	1,091	1,173,000
1984-85	1,042	1,396,000

Source: Australian Fisheries: Dixon et al. 1987:5.

Sillago indica McKay, Dutt and Sujatha, 1985 — Fig. 105 — SILL Sill 16

Sillago (*Parasillago*) *indica* McKay, Dutt and Sujatha, 1985:38-39, fig. 5E (India).

Synonyms: *Sillago parvisquamis* (non *Sillago parvisquamis* Gill): Dutt and Sujatha, 1980:372-374.

FAO Names: **En** - Indian sillago; **Fr** - Pêche-madame indien; **Sp** - Silago indio.

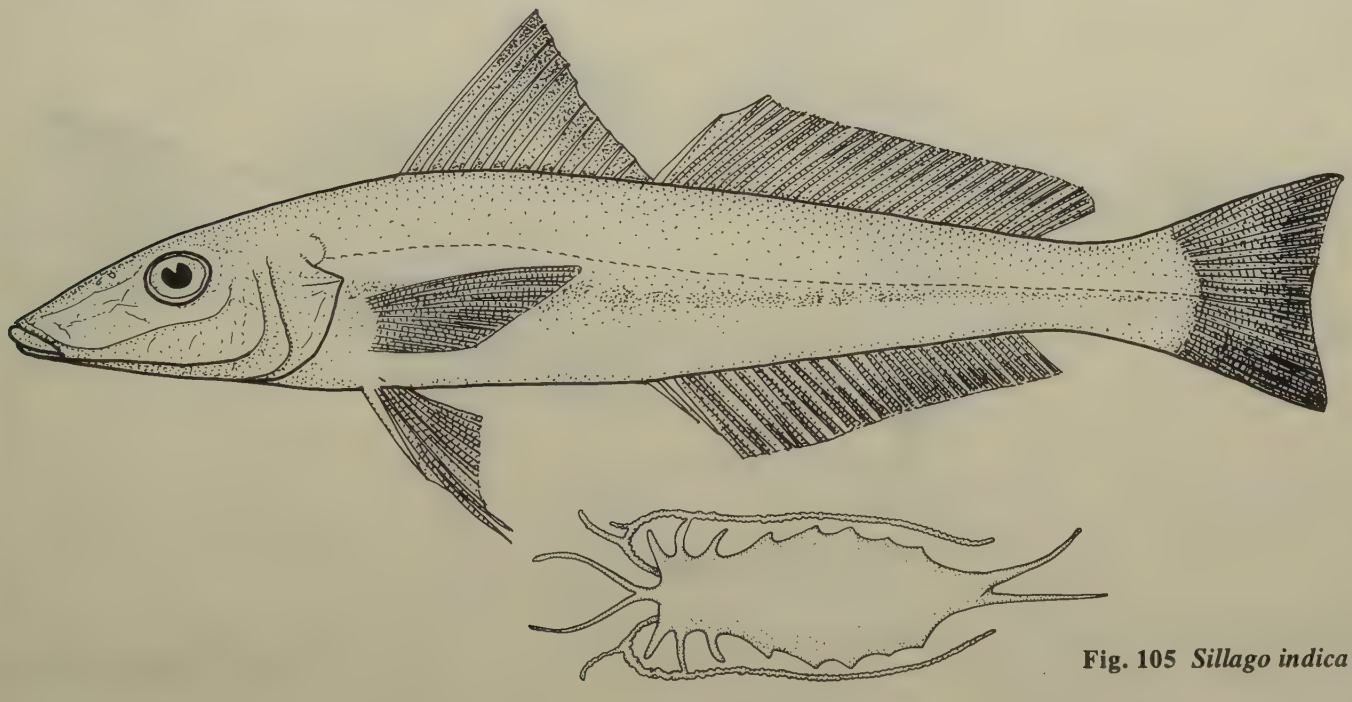


Fig. 105 *Sillago indica*

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 21 or 22 soft rays; anal fin with II spines and 22 or 23 soft rays. Lateral-line scales 68 to 70. Vertebrae: 3 modified, total of 34. Swimbladder with bifurcate anterior extension, anterolateral extensions recurved and extend to ventral duct, posterior extension single. **Colour**: A dark stripe on sides sometimes broken into blotches; body light tan with a dark brown to blackish stripe commencing behind the upper part of the opercle and curving down below the lateral line for approximately two-thirds its length, and then continuing slightly below or on the lateral line to hypural flexure as a more or less broken band or as distinct elongate spots or blotches; head and cheeks with fine black dots; belly and lower sides may be densely dotted, almost blackish; interspinous membranes of first dorsal fin with very numerous black dots; interradial membranes of second dorsal and anal fin dusted with black dots, most concentrated immediately before each ray; caudal dusted with black, lower lobe may be blackish.

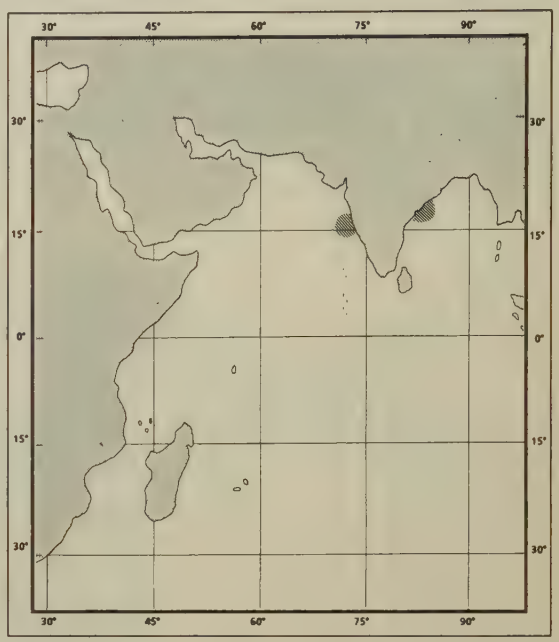


Fig. 106

Geographical Distribution: East and west coasts of India (Fig. 106).

Habitat and Biology: Inshore coastal waters. Inhabits probably depths from 0 to 30 m.

Size: To 17 cm standard length, possibly longer.

Interest to Fisheries: Taken by driftnet, shore seine, cast net and by minitrawlers (Dutt and Sujatha, 1980).

Local Names:

Remarks: Generally confused with other sillaginids in commercial catches.

Sillago ingenuua McKay, 1985 | Fig. 107 | SILL Sill 17

Sillago (*Parasillago*) *ingenuua* McKay, 1985:44, fig. 8C, 14P (Thailand and Torres Straits, Queensland).

Synonyms: *Sillago argentifasciata* (non *Sillago argentifasciata* Martin and Montalban): Shao and Chang, 1978:9, 1979:695-705; Dutt and Sujatha, 1980:371-375.

FAO Names: **En** - Bay sillago; **Fr** - Pêche-madame halanda; **Sp** - Silago de bahia.

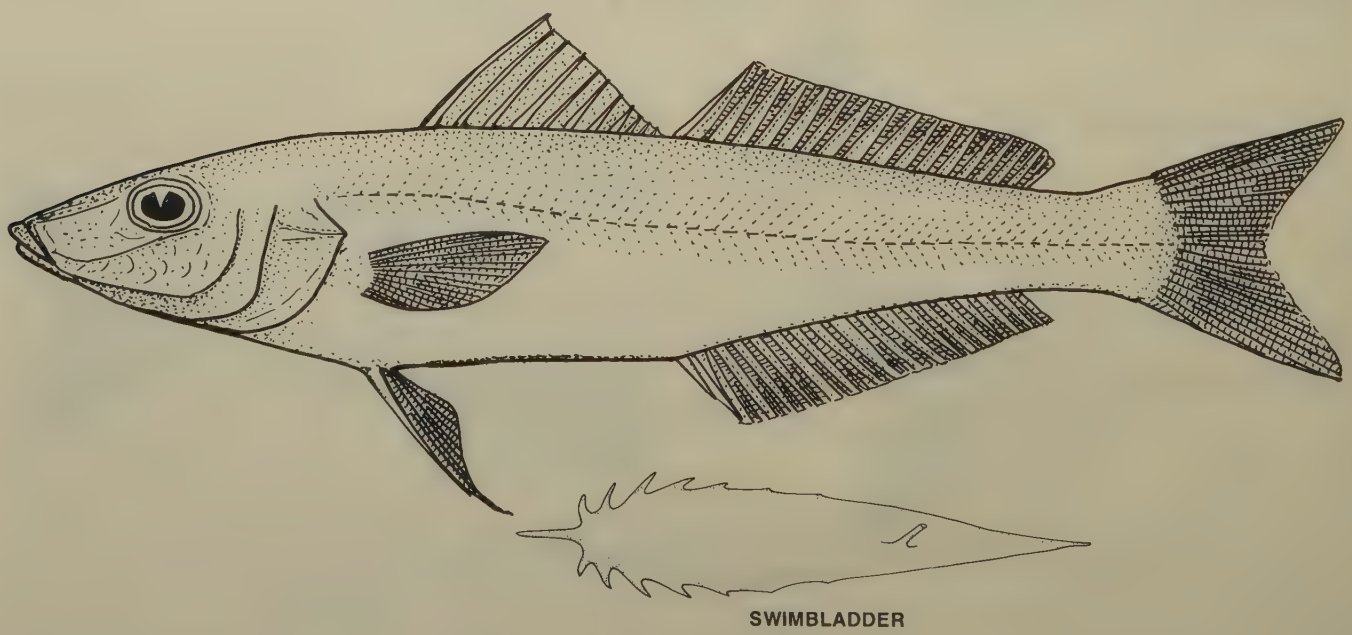


Fig. 107 *Sillago ingenuua*

Diagnostic Features: First dorsal fin with XI spines (last spine very short) and second dorsal fin with I spine and 17 soft rays; anal fin with II spines and 17 soft rays. Lateral-line scales 66 to 70; cheek scales ctenoid. Vertebrae: 13 abdominal + 9 to 11 modified + 9 to 11 caudal, total of 33. Swimbladder with a short median anterior extension and about 5 small, pointed anterolateral projections (Fig. 103). **Colour**: No black spot on pectoral base; no wide distinct silvery lateral band; peritoneum of *S. ingenuua* is black-brown.

Geographical Distribution: Known from the Gulf of Thailand, Taiwan, northern Australia from Shark Bay around the northern coast to Adolphus Passage, northeastern Queensland and India (Fig. 108).

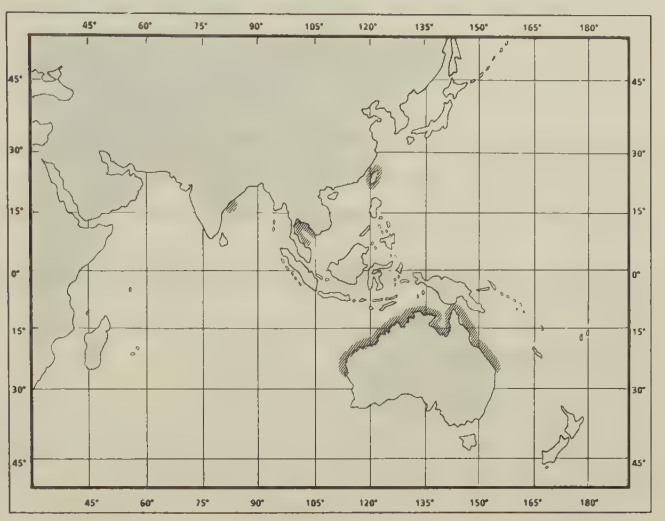


Fig. 108

Habitat and Biology: Inshore coastal waters. Known from depths between 20 and 50 m.

Size: To 20 cm standard length.

Interest to Fisheries: Marketed fresh throughout its range. This species has been taken by trawlers operating on the northwest shelf of Western Australia and occurs southward to Shark Bay. This species is very commonly trawled near Torres Straits.

Local Names: AUSTRALIA: Bay whiting.

Literature: Gloerfelt-Tarp and Kailola (1984:150 *Sillago* sp. 3); Shao et al. (1986:147-148).

Remarks: Possibly more widely distributed than indicated above.

Sillago intermedius Wongratana, 1977 Fig. 109 SILL Sill 18

Sillago intermedius Wongratana, 1977:257-262 (East coast, Gulf of Thailand).

Synonyms: *Sillago maculata* (non *Sillago maculata* Quoy and Gaimard): Dutt and Sujatha, 1980:372-4.

FAO Names: **En** - Intermediate sillago; **Fr** - Pêche-madame murda; **Sp** - Silago intermedio.

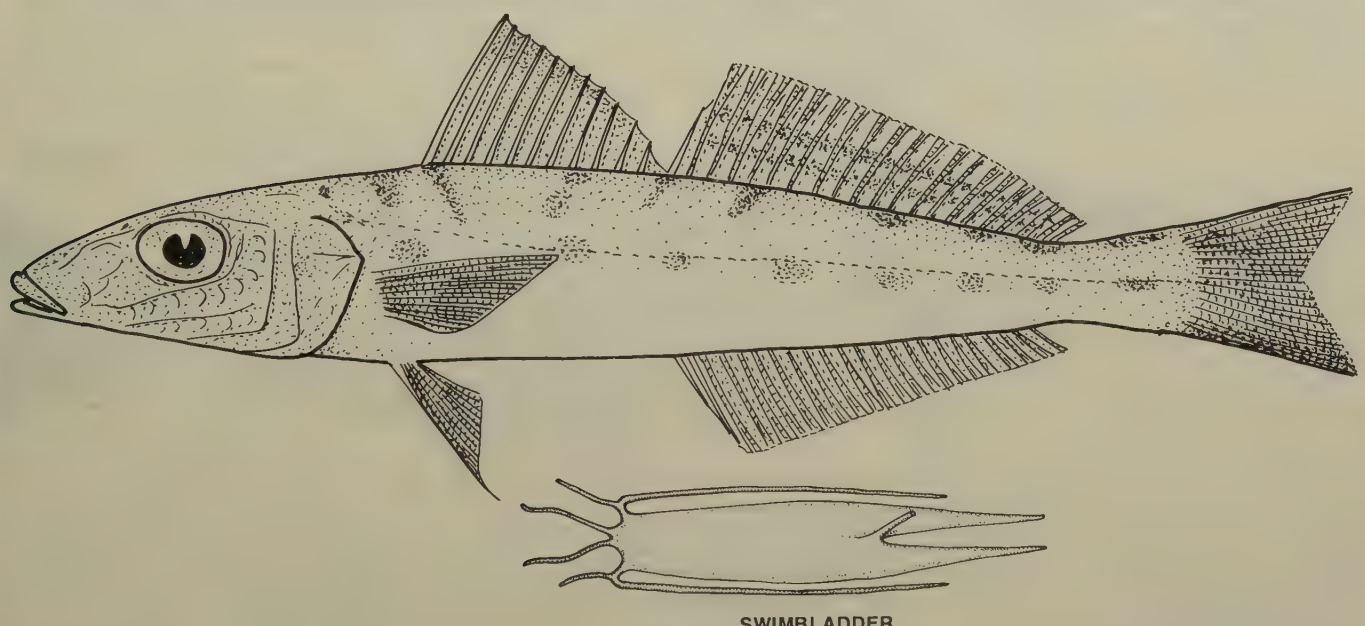


Fig. 109 *Sillago intermedius*
(adapted from Wongratana, 1977)

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 21 or 22 soft rays; anal fin with II spines and 21 or 22 soft rays. Lateral-line scales 67 to 70. Vertebrae: 14 abdominal + 5 modified + 15 caudal, total of 34. Two posterior extensions to the swimbladder; anterior margin with two divergent blind tubes that extend to the basioccipital above the auditory capsule; an anterolateral extension on each side, each sending a blind tubule anteriorly and then curving posteriorly along the abdominal wall as a simple tube to terminate just posterior to the duct-like process. **Colour**: Sides of body just below lateral line with a longitudinal row of dusky black spots, and a series of saddle-like dusky black blotches.

Geographical Distribution: Thailand and India (Fig. 110).

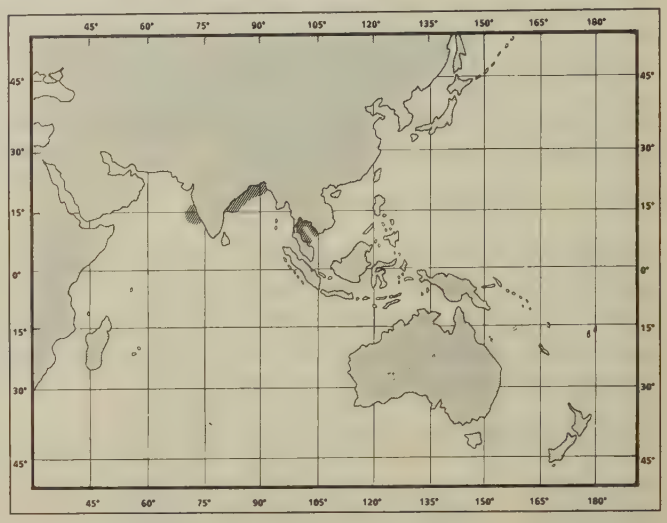


Fig. 110

Habitat and Biology: An inshore species on open silty bottom, at 0 to 10 m depths.

Size: To 20 cm standard length.

Interest to Fisheries: Taken locally and marketed fresh.

Local Names:

Remarks: *Sillago intermedius* is similar to *S. sihama* but may be distinguished by the coloration and the simple lateral tubular extensions of the swimbladder.

Sillago japonica Temminck and Schlegel, 1843 | Fig. 111 | SILL Sill 19

Sillago japonica Temminck and Schlegel, 1843:23, 24, pl. 10, fig. 1 (Japan).

Synonyms: *Sillago sihama* (non *Sillago sihama* Forsskål): Steindachner and Döderlein, 1885:192; Nogusa, 1951:153-155, 1960:26; Ueno and Fujita, 1954:118-120, fig. 1; Okada, 1955:256; Hotta, 1961:62, pl. 33, fig. 99; Takahashi, 1962:24, pl. 57; Kawanabe et al., 1968:54; Kakuda, 1970 (ecology and fishery); Kawamura et al., 1975:797 (burrowing behaviour); Hiramoto, 1976 (artificial spawning).

FAO Names: **En** - Japanese sillago; **Fr** - Pêche-madame japonais; **Sp** - Silago japones.

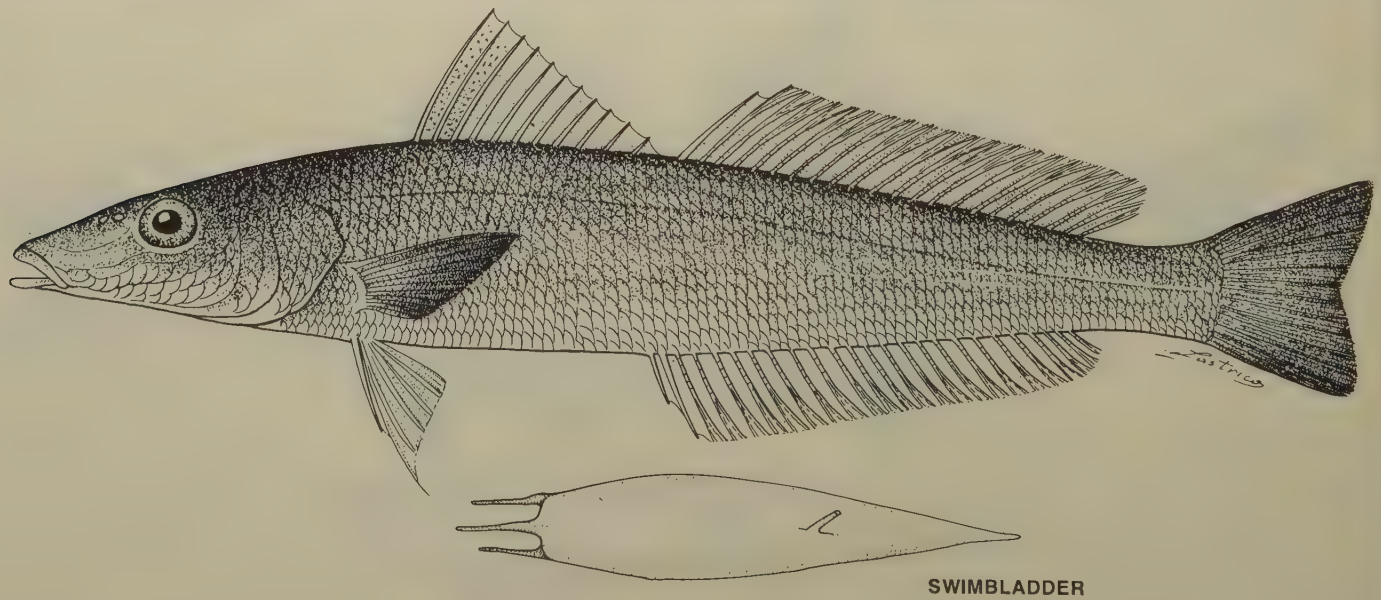


Fig. 111 *Sillago japonica*
(adapted from Bleeker, 1877)

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 21 to 23 soft rays; anal fin with II spines and 22 to 24 soft rays. Lateral-line scales 70 to 73. Vertebrae: 14 abdominal + 8 or 9 modified (overlapping posterior extension of swimbladder)+ 12 or 13 caudal, total of 35. Swimbladder with anterior projecting extensions and a single posterior extension. **Colour**: Body greenish grey above, the dorsal part of the head being the darker, and whitish below; first and second dorsal fin mostly hyaline, the membrane between the first and second and the second and third dorsal-fin spines having minute dark brown dots; margins of dorsal fins with a few dark brown spots; anal and ventral fins hyaline; pectoral fins hyaline with the upper margin and base dark greenish; caudal whitish with dark margins.

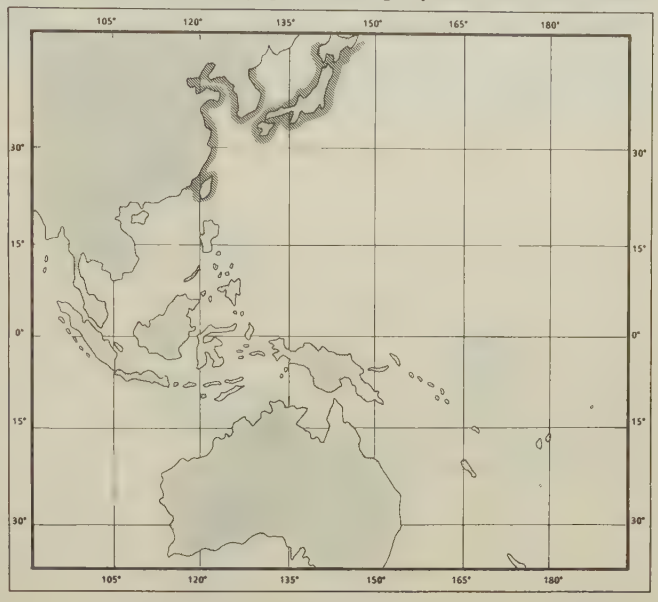


Fig. 112

Geographical Distribution: Japan, Korea, China and Taiwan. Possibly to the Philippines (Masuda et al., 1984) (Fig. 112).

Habitat and Biology: The common whiting of Japan, occurring in bays on shallow sandy flats, in depths between 0 and 30 m.

Size: To 22 cm standard length.

Interest to Fisheries: An important inshore foodfish greatly esteemed for its delicate flavour. Now a subject of aquaculture.

Local Names: JAPAN: Shiro-gisu; TAIWAN: Chin-Sa-Suo.

Literature: Richardson (1846:223, Canton, China); Bleeker (1853:28, 1858:11, 1859:163, description, 1865:56, China, 1875:69-71, 1877, pl. 389, fig. 6, 1879:9); Günther (1860:244-245, 1880:66); Gill (1861:503-504); Steindachner and Döderlein (1885:192); Jordan and Snyder (1901:109, description, Yokohama, 1902:487); Smith and Pope (1906:478, Kochi); Jordan et al. (1913:187); Fowler and Bean (1922:69, description, Takao); Jordan and Hubbs (1925:248, Japan, localities); Reeves 1927:10); Mori (1928:6, Fusan, Korea); Fowler (1930b:654, 1931b:302, Hong Kong, 1949:51, China, Korea, Taiwan, localities); Weber and de Beaufort (1931:170, 173-174, description); Herre (1945:118, 1953:478 many localities); Boeseman (1947:38); Tomiyama and Abe (1958:1171-1176, pl. 229, fig. 581, description, distribution); Munro (1958:178, New Guinea, misidentified?, 1967:347); Hotta (1961:62); Whitehead and Joysey (1967:139); Masuda et al. (1975, pl. 54C, as *S. sihama*); Shao and Chang (1978:9, pl. 1, fig. 5 and pl. 2, fig. 5); Chen and Yu (1982, culture); Tsukashima et al. (1983, fry rearing); Kurahawa and Suzuki (1983, larval feeding); Masuda et al. (1984, pl. 134A, p. 151); Sano and Mochizuki (1984:145-146, fig. 1D, revision); McKay (1985:42-43, figs); Oozeki and Hirano (1985, temperature and development of eggs); Yu and Tung (1983, growth and culture, 1985, culture); Kashiwagi et al. (1987, egg size and hatching); Hirai, 1988, egg micropyle); Kobayashi et al. (1988, culture).

Remarks: This species was commonly misidentified as *Sillago sihama*.

Sillago lutea McKay, 1985 | Fig. 113 | SILL Sill 20

Sillago (*Parasillago*) *lutea* McKay, 1985:40-42, figs 10D, 13H-I, 18 (Australia, India and Sri Lanka).

Synonyms: *Sillago macrolepis* (non *Sillago macrolepis* Bleeker): Dutt and Sujatha, 1980:372-374.

FAO Names: **En** - Mud sillago; **Fr** - Pêche-madame de vase; **Sp** - Silago de fango.

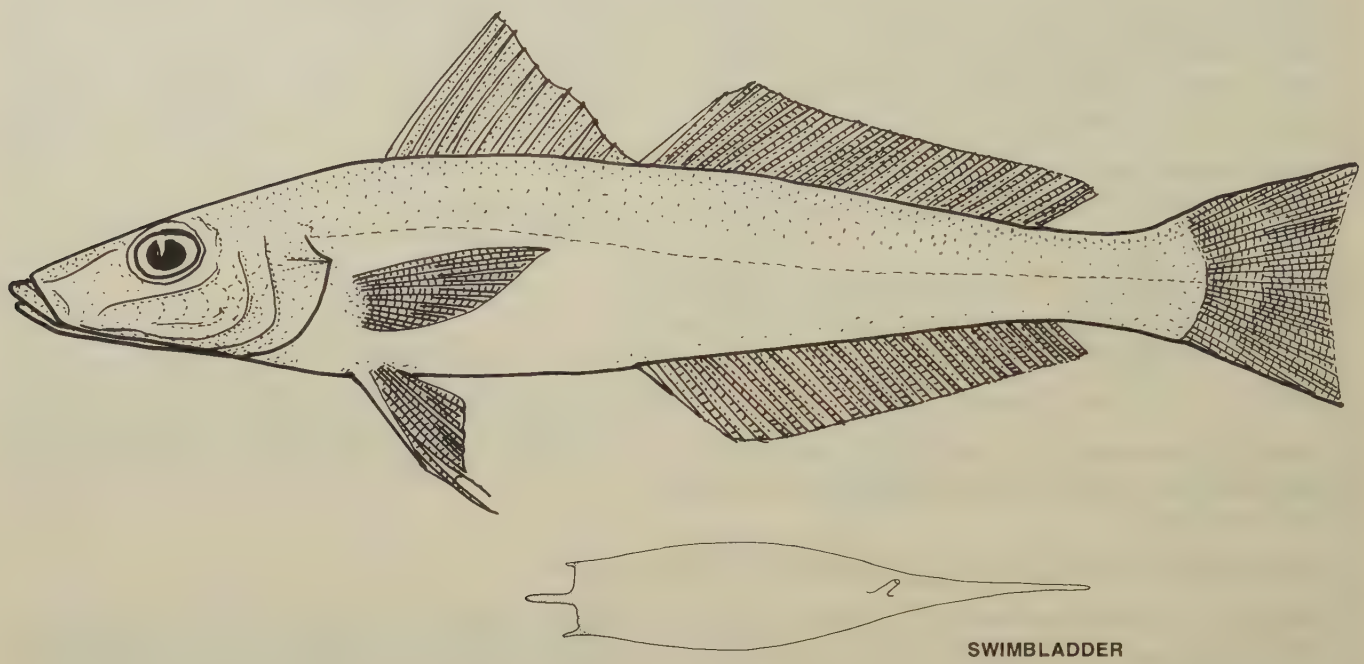


Fig. 113 *Sillago lutea*

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 20 to 22 soft rays; anal fin with II spines and 21 to 23 soft rays. Lateral-line scales 67 to 72. Vertebrae: 13 or 14 (normally 13) abdominal + 4 to 11 modified + 10 to 17 caudal, total of 33 to 35. Swimbladder with a median anterior extension and with or without rudimentary anteriorly directed anterolateral projections; posterior extension single. **Colour**: Body light sandy brown above, pale brown to whitish below, with an ill defined silvery mid-lateral band; margins of scales may be slightly darker giving a vague meshwork pattern to the body above the lateral line; fins hyaline, the first dorsal-fin membrane tipped with a fine dusting of black; no dark spot at the base of the pectoral fin.

Geographical Distribution: Exmouth Gulf, Western Australia, northward and eastward to Gulf of Carpentaria, India and Sri Lanka (Fig. 114).

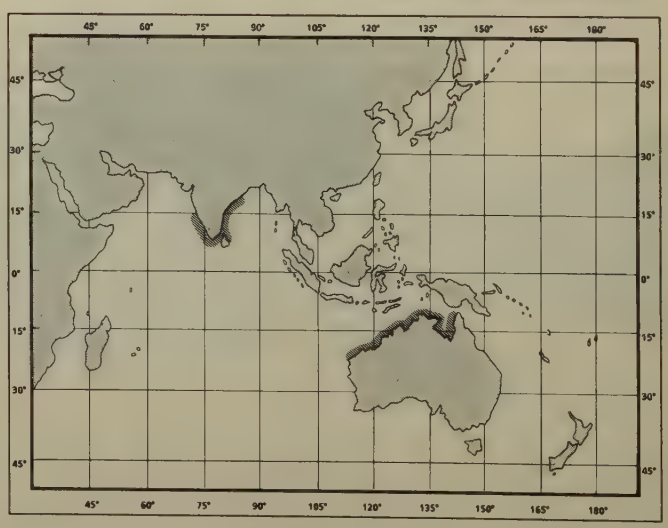


Fig. 114

Habitat and Biology: This species is commonly associated with the banana prawn *Penaeus merguiensis* de Man in northern Australia, and occurs most abundantly on muddy or very silty substrates. Usually found at depths of 0 to 60 m. It attains sexual maturity at 100 mm standard length (ripe females 104 to 120 mm).

Size: To 16 cm standard length.

Interest to Fisheries: A small species taken by trawl net. Of minor interest but small catches are taken by trawlers in the Gulf of Carpentaria to Exmouth Gulf. Large catches are taken by prawn trawlers but as the species grows to only 16 cm, the catch is of no commercial importance at present. This species could form the basis of a small bycatch fishery, to be exported ungutted.

Local Names: AUSTRALIA: Mud whiting.

Literature: Gloerfelt-Tarp and Kailola (1984:150).

Remarks: ***Sillago lutea*** may be confused with ***Sillago sihama*** and ***Sillago japonica***. The swimbladder and cranial osteology is very similar to that of ***Sillago japonica*** but the majority of specimens have 13 abdominal vertebrae and a total count of 33, rather than 14 abdominal vertebrae and a total of 34, and attain sexual maturity at a smaller size. The number of scales between the first dorsal-fin origin and the lateral line afford a reliable external determination of the two species since *S. lutea* has 5 scales and *S. japonica* 3.

Sillago macrolepis Bleeker, 1859 | Fig. 115 | SILL Sill 21

Sillago macrolepis Bleeker, 1859:166 (Batavia; Bodeling, Bali).

Synonyms: ***Sillago*** (***Parasillago***) ***macrolepis***: McKay, 1985:39-40, figs 4E, 13J, 18.

FAO Names: **En** - Large-scale sillago; **Fr** - Pêche-madame grandes écailles; **Sp** - Silago escamoso.

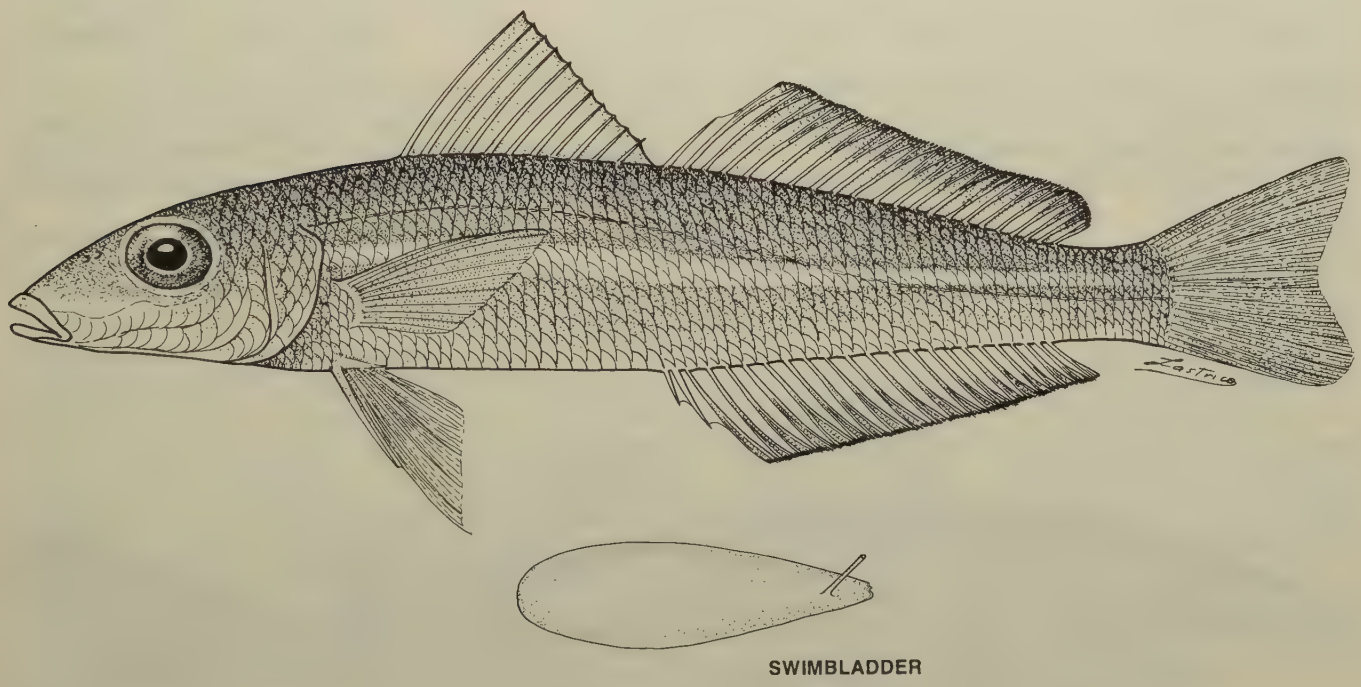


Fig. 115 ***Sillago macrolepis***
(after Bleeker, 1877)

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 19 to 21 soft rays; anal fin with II spines and 19 to 21 soft rays. Lateral-line scales 51 to 56. Vertebrae: 14 abdominal + 20 caudal, total of 34 (no haemal bridge overlying the swimbladder). **Colour**: Yellowish, darker above, with a diffuse silvery midlateral stripe; dorsal fins dusky with a narrow blackish margin. Juveniles with a series of small brown spots, on each side along the back at the base of the dorsal fins, first dot at commencement of spinous dorsal fin, second about middle of spinous dorsal fin, third below fourth dorsal-fin ray, fourth below eleventh dorsal-fin ray, and last spot below end of second dorsal fin.

Geographical Distribution: Recorded from the Indonesian Archipelago, New Britain, Solomon Islands and the Philippine Islands (Fig. 116).

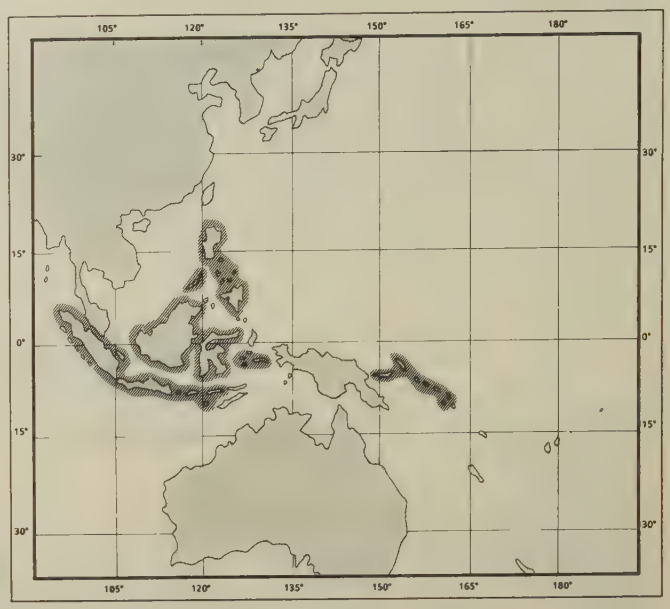


Fig. 116

Habitat and Biology: Enters estuaries and may penetrate freshwater, at least as juveniles. Inhabits depths of 0 to 5 m.

Size: To 20 cm standard length.

Interest to Fisheries: Of minor importance at present.

Local Names:

Literature: Bleeker (1874:72, 1877, pl. 389, fig. 1); Günther (1860:246, description); Meyer (1885:28); Evermann and Seale (1907:87); De Beaufort (1913:120); Fowler (1928:235, 1933:16, 1934:422); Weber and de Beaufort (1931:171, description); Herre (1933:4, Sandakan, North Borneo, 1953:478); Munro (1958:178, New Guinea, 1967:346).

Remarks: The large eye, although not diagnostic, is a useful means of field identification as it is noticeably directed dorsally to provide for surface vision in shallow mangrove streams.

Sillago maculata Quoy and Gaimard, 1824 — Fig. 117 — SILL Sill 1

Sillago maculata Quoy and Gaimard, 1824:261, pl. 5, fig. 2. (Sydney, New South Wales).

Synonyms: *Sillago gracilis* Alleyne and Macleay, 1877:279, pl. 6, fig. 2 (Torres Strait, Darnley Island or Hall Sound); Macleay, 1881:202; McCulloch, 1911:60. *Sillago* (*Parasillago*) *maculata maculata*: McKay, 1985:22-24, figs (revision).

FAO Names: **En** - Trumpeter sillago; **Fr** - Pêche madame trompette; **Sp** - Silago trompetero.

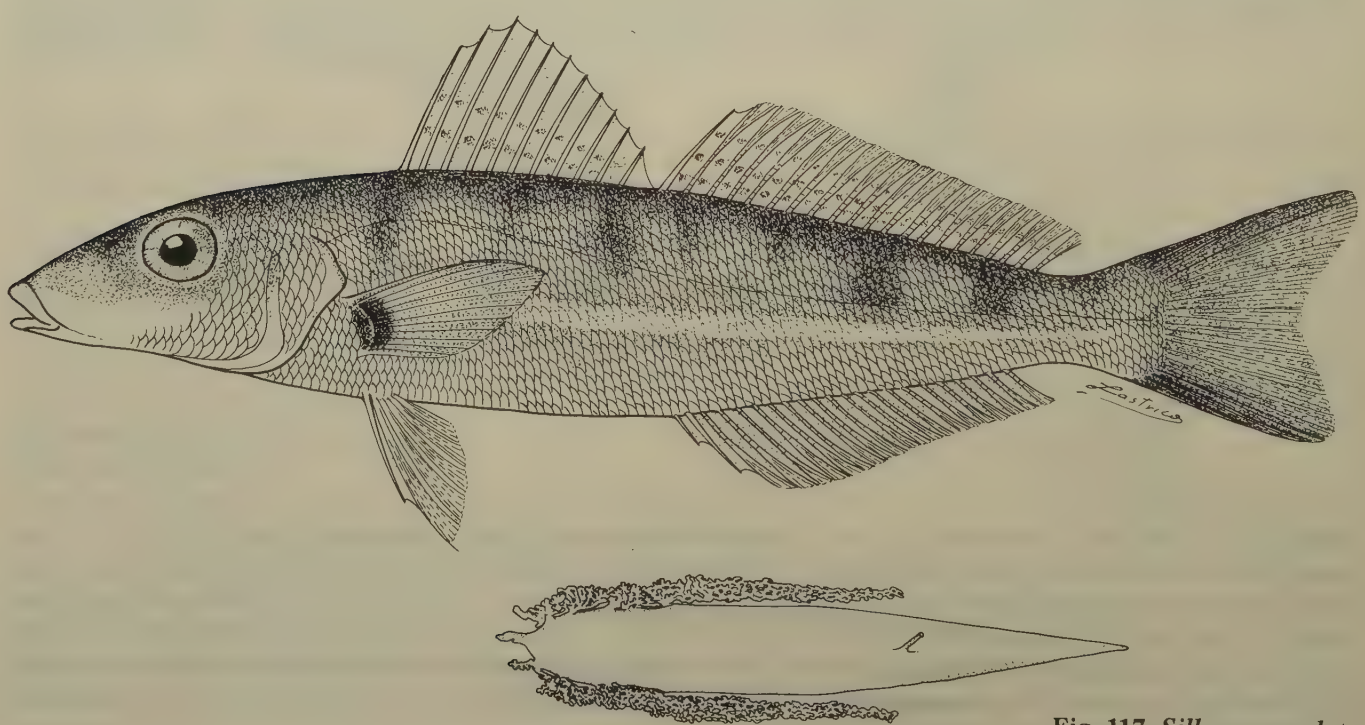


Fig. 117 *Sillago maculata* **(adapted from Grant, 1972)**

Diagnostic Features: First dorsal fin with XI (rarely XII) spines and second dorsal fin with I spine and 19 to 21 soft rays; anal fin with II spines and 19 or 20 soft rays. Lateral-line scales 71 to 75. Vertebrae: 13 to 15 abdominal + 8 to 11 modified + 10 to 14 caudal, total of 34 to 36. Anterolateral extensions of swimbladder recurved posteriorly to reach level of vent. **Colour**: A black spot at base of pectoral fin, dark blotches on back and side of body, the upper and lower blotches are frequently joined, at least posteriorly, the upper blotches are generally larger; the opercle is dull or with an inner dark blotch showing through. Coloration similar to *S. burrus* and *S. aeolus*.

Geographical Distribution: East Coast of Australia (Fig. 118).

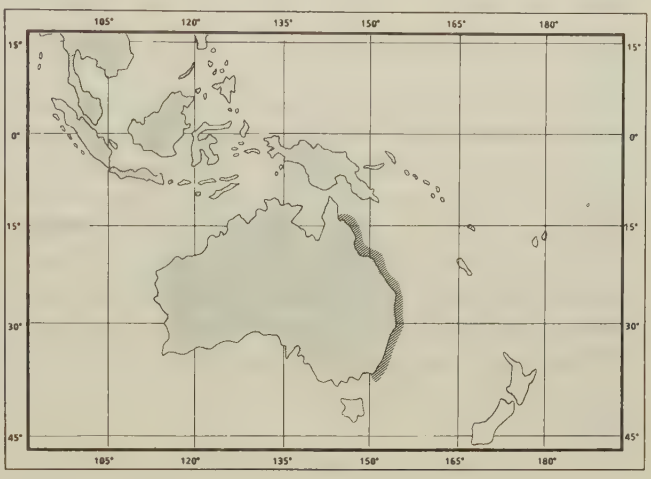


Fig. 118

Habitat and Biology: Found on silty and muddy substrates in the deeper water of bays, but also frequenting the mouths of rivers, estuaries and mangrove creeks. It is known from a depth range of 0 to 50 m. The juveniles are most abundant in estuaries and shallow water during the summer months, moving into deeper water as they mature. Burchmore et al. (1988) found that within Botany Bay, New South Wales, this species has an extended reproductive period from October to April, with fish running ripe most abundant in December and February. As relatively large numbers of fish running ripe were taken over deep sand or mud sites, they hypothesized that this species spawns within the Bay. Diet of juveniles is largely small crustaceans and that of the adult fish mostly polychaete worms.

Size: To 30 cm total length.

Interest to Fisheries: A very popular angling fish taken in large numbers by dinghy fishermen during the winter months in southern Queensland. Large quantities are taken by trawlers working in Moreton Bay, mainly as a bycatch of the prawn fishery. The fish are marketed fresh. Trawled fish are frequently bruised and the flesh may spoil rapidly. For this reason it is not as popular in the market as netted species.

Local Names: AUSTRALIA: Trumpeter whiting, Winter whiting, Diver whiting.

Literature: Cuvier (1829:411); Bleeker (1849:5, 8, 10, 14, 62, part, 1874:71, part); Günther (1860:245); Steindachner (1866:444-445, 1870:562); Castelnau (1875:16, 1979:380); Alleyne and Macleay 1877:279); Klunzinger (1879:370); Schmeltz (1879:44); Macleay (1881:201); Tenison-Woods (1882:65, pl. 23); Pohl (1884:32); Ogilby (1886:31, 1893:101); Johnston (1891:33); Cohen (1892:16); Waite (1898:30, 1899:109, 1902:190, 1904:31); Stead (1906a:574-576, 1908b:64); McCulloch (1911:61, 1921:61, 1927:51, pl. 21, fig. 1846); Weber (1913:267); Fowler (1925:248, 1933:423-425, part); Barnard (1927:508); Weber and de Beaufort (1931:174, part); Borodin (1932:85); Herre (1939:327, 1953:478-479, part); Smith (1949:204); Roughley (1951:48, pl. 16); Palakar and Bal (1955:128, part); Scott (1959:56); Marshall (1964:169, pl. 34); Whitley (1964:43); Grant (1965:86, fig., 1972:246, fig.); Maclean (1971:87-92); Weng (1983, 1986); Hutchins and Swainston (1986:col. pl. 267b).

Remarks: The species is geographically sympatric with the western trumpeter whiting (see *Sillago burrus*) and, therefore, both are treated as full species in this work as is *Sillago aeolus*.

Sillago megacephalus Lin, 1933 (No figure available) SILL Sill 22

Sillago megacephalus Lin, 1933:96, fig. 3 (Paoping Harbour, Hainan, China).

Synonyms: None.

FAO Names: **En** - Large-headed sillago; **Fr** - Pêche-madame grande tête; **Sp** - Silago cabezudo.

Diagnostic Features: Very similar to *Sillago sihama*, but with the head length 33% of standard length. First dorsal fin with XI spines and second dorsal fin with I spine and 22 soft rays; anal fin with II spines and 23 soft rays. Lateral-line scales about 70.

Geographical Distribution: China (Fig. 119).

Habitat and Biology: Unknown.

Size: Described from a small specimen (158 mm standard length).

Interest to Fisheries: Unknown.

Local Names:

Literature: Fowler, 1949:51.

Remarks: *Sillago megacephalus* is known only from the description of the holotype, the holotype itself is apparently lost (McKay, 1985). It is unusual in having the head length 33% of the body length according to the description of Lin (1933). *Sillago sihama* rarely has the head length to 30%, and in most specimens the head length is about 27% to 28% of standard length. The dimensions from the figure of *S. megacephalus* in Lin (1933) give a head length of about 27% standard length. This species is possibly a junior synonym of *Sillago sihama*.

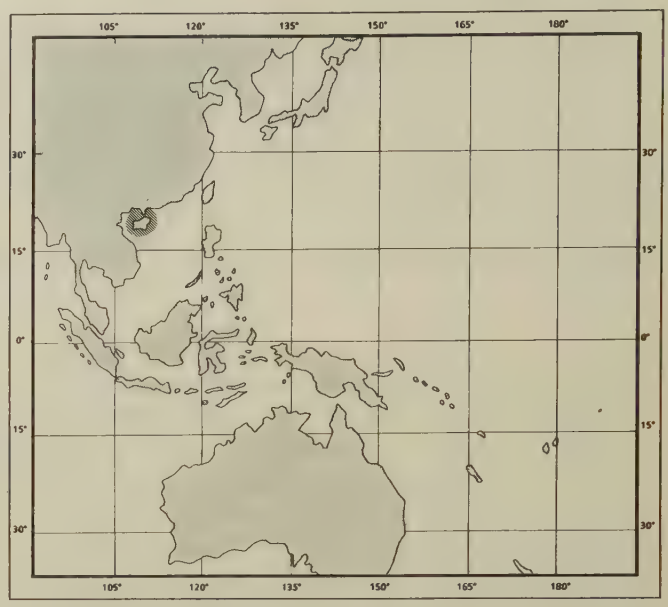


Fig. 119

Sillago microps McKay, 1985 | Fig. 120 | SILL Sill 23

Sillago (*Parasillago*) *microps* McKay, 1985:44-45 (Taipei Market, Taiwan).

Synonyms: None.

FAO Names: **En** - Small-eyed sillago; **Fr** - Pêche-madame petits yeux; **Sp** - Silago de ojos pequeños.

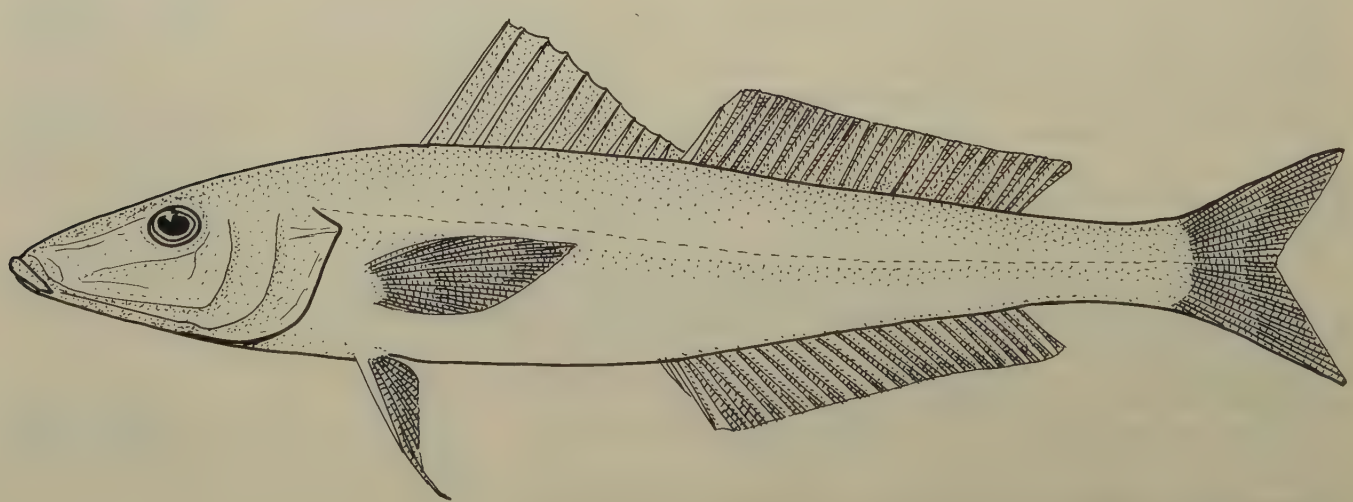


Fig. 120 *Sillago microps*

Diagnostic Features: A small eye (14% to 16% of head length). First dorsal fin with XI spines and second dorsal fin with I spine and 19 soft rays; anal fin with II spines and 19 soft rays. Lateral-line scales 68 to 69; cheek scales cycloid. Vertebrae: 13 abdominal + 5 modified + 16 caudal.

Geographical Distribution: Taiwan (Fig. 121).

Habitat and Biology: Unknown.

Size: To at least 20 cm standard length.

Interest to Fisheries: None.

Local Names:

Literature: Shao et al., 1986:148-149.

Remarks: This new species is known only from the holotype and one paratype from Taiwan, collected with two specimens of ***Sillago parvisquamis***, and one specimen of ***Sillago sihama***. Not collected by Shao et al. (1986) in their review of the family from Taiwan. The swimbladder structure is unknown at present.

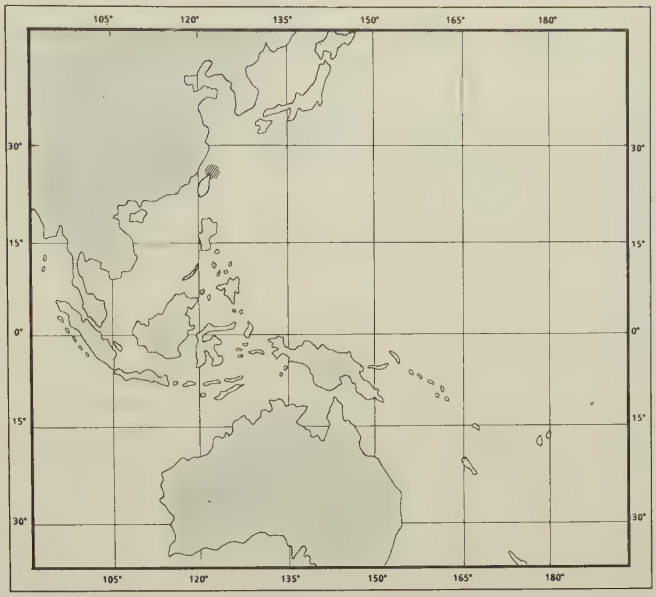


Fig. 121

Sillago nierstraszi Hardenberg, 1941 | Fig. 122 | SILL Sill 24

Sillago nierstraszi Hardenberg, 1941:228 (Merauke, New Guinea).

Synonyms: ***Sillago* (*Parasillago*) *nierstraszi***: McKay, 1985:19-20.

FAO Names: **En** - Rough sillago; **Fr** - Pêche-madame rêche; **Sp** - Silago rugoso.

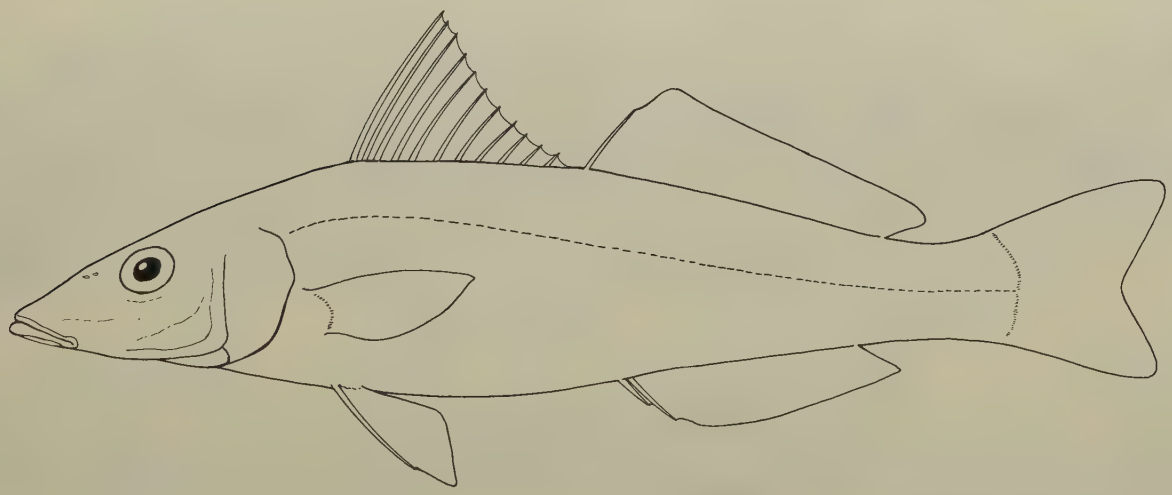


Fig. 122 ***Sillago nierstraszi***

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 17 soft rays; anal fin with II spines and 17 soft rays. Between base of first dorsal-fin spine and lateral line 4 scales.

Geographical Distribution: Southern New Guinea (Fig. 123).

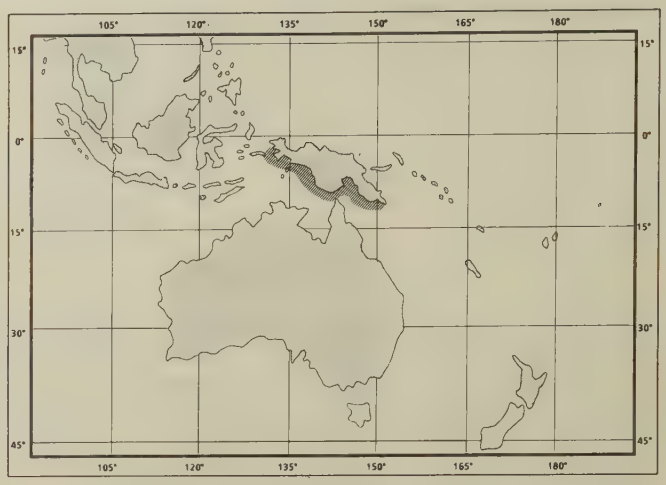


Fig. 123

Habitat and Biology: Inshore benthic habitat.

Size: The holotype was reported as 25 cm total length (Hardenberg, 1941).

Interest to Fisheries: None.

Local Names:

Literature: Munro, 1958:178.

Remarks: Possibly a senior synonym of ***Sillago analis***. ***Sillago nierstraszi*** is known only from the holotype which could not be located. Hardenberg (1941:288) states that this species is related to ***Sillago macrolepis*** according to the lateral-line scales (***S. macrolepis*** has 52 to 56 lateral-line scales), but differs in the transverse scale count, the smaller eye, the low anal-fin ray count, and in having ctenoid scales on the head. In most features ***Sillago nierstraszi*** is similar to ***Sillago analis*** and may prove to be a senior synonym.

Sillago parvisquamis Gill, 1861 | Fig. 124 | SILL Sill 25

Sillago parvisquamis Gill, 1861:505 (Kanagawa, near Yokohama).

Synonyms: ***Sillago sihama*** (non ***Sillago sihama*** Forsskål): Tanaka, 1913:241, pl. 68, fig. 244; Masuda et al., 1984:151, pl. 134-C. ***Sillago* (*Sillago*) *parvisquamis***: McKay, 1985:12-13, figs 2D, 7A, 13B, 14B, 15.

FAO Names: **En** - Small-scale sillago; **Fr** - Pêche-madame petites écailles; **Sp** - Silago liso.

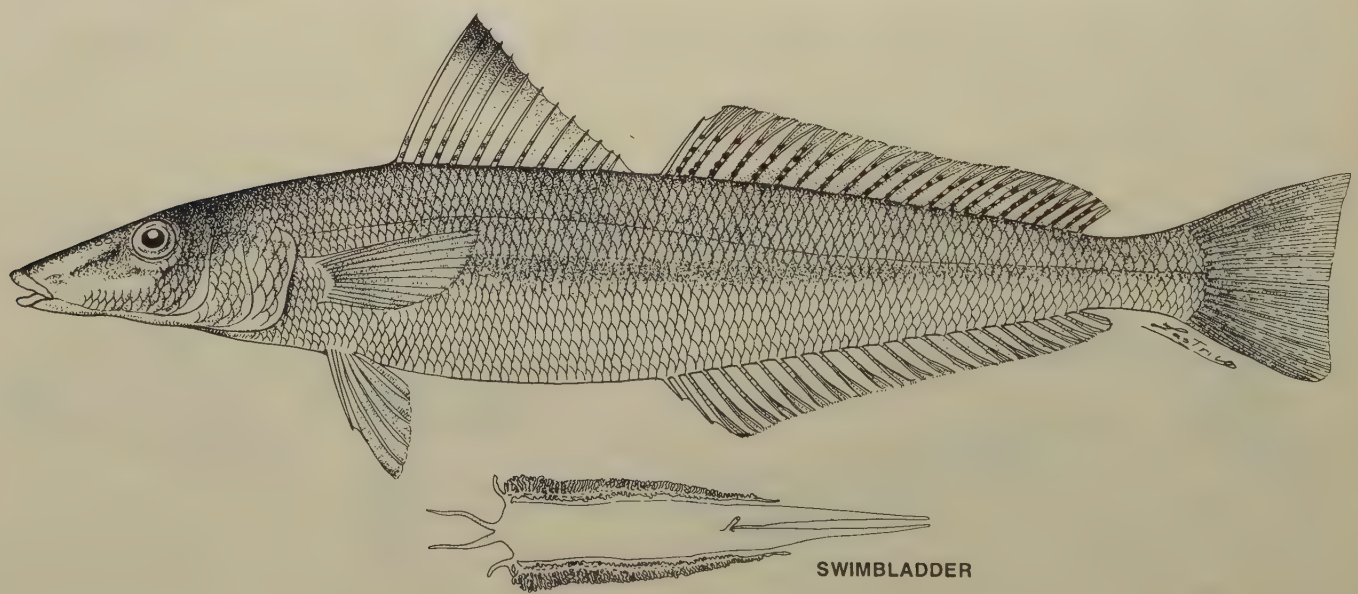


Fig. 124 ***Sillago parvisquamis***

Diagnostic Features: First dorsal fin with XII or XIII spines and second dorsal fin with I spine and 20 to 22 soft rays; anal fin with II spines and 22 or 24 soft rays. Lateral-line scales 79 to 84. Vertebrae: 16 abdominal + 5 or 6 modified + 17 to 19 caudal, total of 39 to 40. Swimbladder with two posterior extensions. **Colour**: Pale brown to dull brown above, lighter below; a faint mid-lateral stripe usually present; dorsal fins dusky terminally with five or six rows of dusky spots on second dorsal fin membranes, other fins hyaline.

Geographical Distribution: Tokyo and Yokohama, Tokyo Bay, Japan, Taiwan (Fig. 125).

Habitat and Biology: Inhabits tidal flats in the estuary zone near large rivers. Occurs in depths between 0 and 30 m.

Size: To 30 cm standard length.

Interest to Fisheries: The fishery is possibly in decline due to habitat alteration by reclamation and pollution (Sano and Mochizuki, 1984).

Local Names: JAPAN: Ya-gisu, Ao-gisu.

Literature: Jordan et al. (1913:187); Jordan and Hubbs (1925:248); Fowler (1933:427-428); Tomiyama and Abe (1958:1176-1177); Shao and Chang (1978:5-6, pl. 1, fig. 2, and pl. 2. fig. 2, 1979:695-705); Sano and Mochizuki (1984:141-143, fig. 1B); Shao et al. (1986:147, fig. 6C).

Remarks: Possibly a candidate for aquaculture. The flesh is firm and well accepted in Japan.

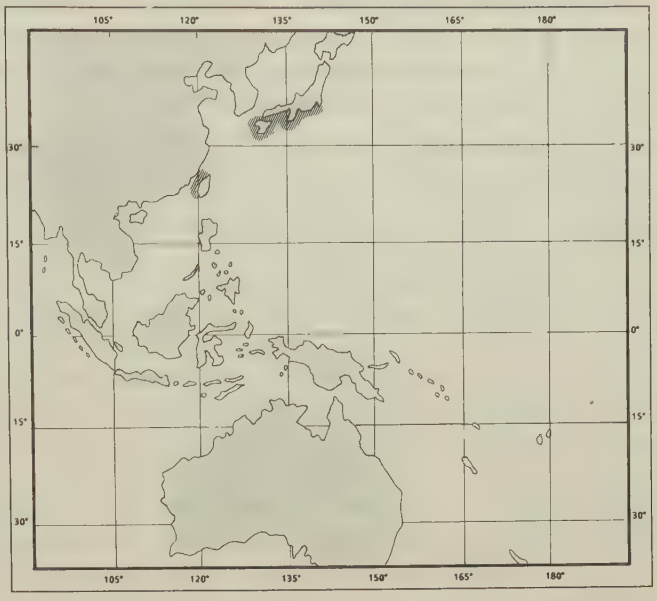


Fig. 125

Sillago robusta Stead, 1908 — Fig. 126 — SILL Sill 26

Sillago robusta Stead, 1908a:7 (Rose Bay, Port Jackson, New South Wales).

Synonyms: *Sillago auricomis* Ogilby, 1910:97-98 (Between Moreton Island and Hervey Bay); Whitley, 1932a:344; Ladiges et al., 1958:164-165. *Sillago* (*Parasillago*) *robusta*: McKay, 1985:30-33, figs 4C, 11D-J, 13R-T, 14M-N, 18.

FAO Names: **En** - Stout sillago; **Fr** - Pêche-madame gaillard; **Sp** - Silago obeso.

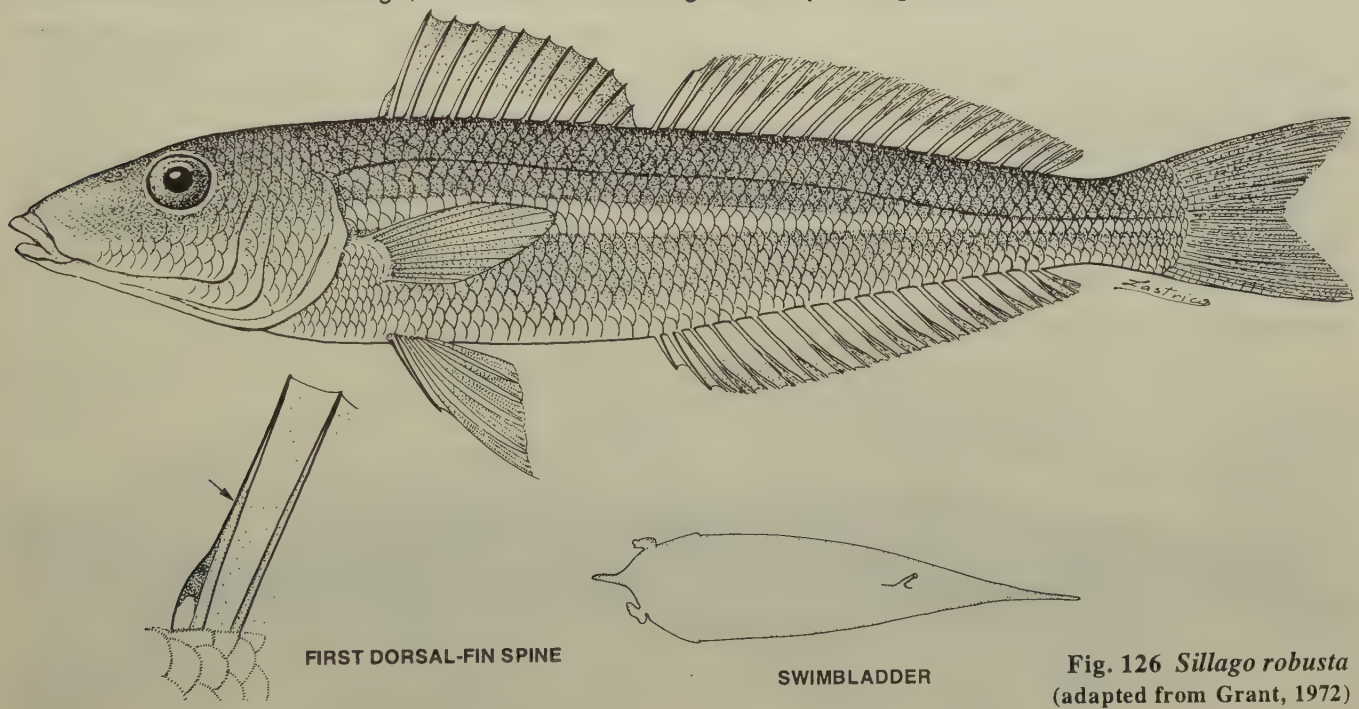


Fig. 126 ***Sillago robusta*** **(adapted from Grant, 1972)**

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 16 to 18 soft rays, first dorsal-fin spine of large specimens with a sharply keeled anterior edge; anal fin with II spines and 16 or 19 soft rays. Lateral-line scales 64 to 70. Vertebrae: 13 abdominal + 20 caudal, total of 33. **Colour**: The base of the first dorsal-fin spine yellow and remainder of its keel dark brown to blackish; body with a midlateral silvery stripe, and a yellow blotch on cheek.

Geographical Distribution: Endemic to Australian waters from Fremantle northward to Shark Bay (western population), and from southern Queensland to New South Wales (eastern population) (Fig. 127).

Fig. 127

Habitat and Biology: Offshore species inhabiting sandy substrates, between 10 and 70 m. Inside Shark Bay, Western Australia, and Moreton Bay, Queensland, the species is common, but not abundant, and is usually associated with *Sillago maculata*. Most of the stout sillago taken by trawlers inside Moreton Bay are juveniles less than 10 cm (Weng, 1986). Juveniles feed largely on crustaceans such as copepods (39%) and mysidaceans (15%) whereas larger fishes (11 to 20 cm) consume more polychaetes (Burchmore et al., 1988). In more northern areas in sandy-mud or turbid silty areas, it is replaced by *Sillago lutea*. Attains sexual maturity below a standard length of 13 cm and rarely exceeds 17 cm in Western Australia, although the species has been recorded to 28 cm in length by trawling vessels working in depths of 63 m off southern Queensland (Grant 1965).

Size: To 30 cm total length.

Interest to Fisheries: Occasionally marketed fresh as a bycatch of prawn trawlers working off Moreton Bay. The bulk of the catch is below 25 cm and until recently did not fetch a good price. A small fishery is developing on the trawl grounds outside Moreton Bay and is now subject to research. Sometimes marketed in Asian food stores in Brisbane. The flesh is soft and trawled fish are frequently bruised. The stout sillago may comprise up to 10% of the "school" whiting (*S. flindersi*) catch in New South Wales.

Local Names: AUSTRALIA: Stout whiting.

Literature: McCulloch (1921:61); Marshall (1964:170); Whitley (1964:43); Grant (1965:87, 1972:247, fig.); Allen and Swainston (1988:col. pl. 355, W.A. form); Burchmore et al. (1988, biology).

Remarks: This little known species is now targeted as a valuable component of the prawn trawl bycatch.

Sillago schomburgkii Peters, 1865 | Fig. 128 | SILL Sill 27

Sillago schomburgkii Peters, 1865:319 (Adelaide, South Australia).

Synonyms: *Sillago bostockii* Castelnau, 1873:133 (Swan River and at sea, Western Australian); McCulloch, 1911:60, 63, 1912:87-88; Whitley, 1948:19, 1951:65. *Sillago bassensis* (non *Sillago bassensis* Cuvier): Waite, 1902:190-191, 1921:101, 1923:123-124, 1928. *Sillago frazeri* Whitley, 1944:270 (Leschenault Inlet, Bunbury, Western Australia), 1948:19, 1951:65; Roughley, 1951:49. *Sillago* (*Parasillago*) *schomburgkii*: McKay, 1985:34-36, figs 4D, 11C, 13W, 14O, 18.

FAO Names: **En** - Yellowfin sillago; **Fr** - Pêche-madame ubi; **Sp** - Silago aleta amarilla.

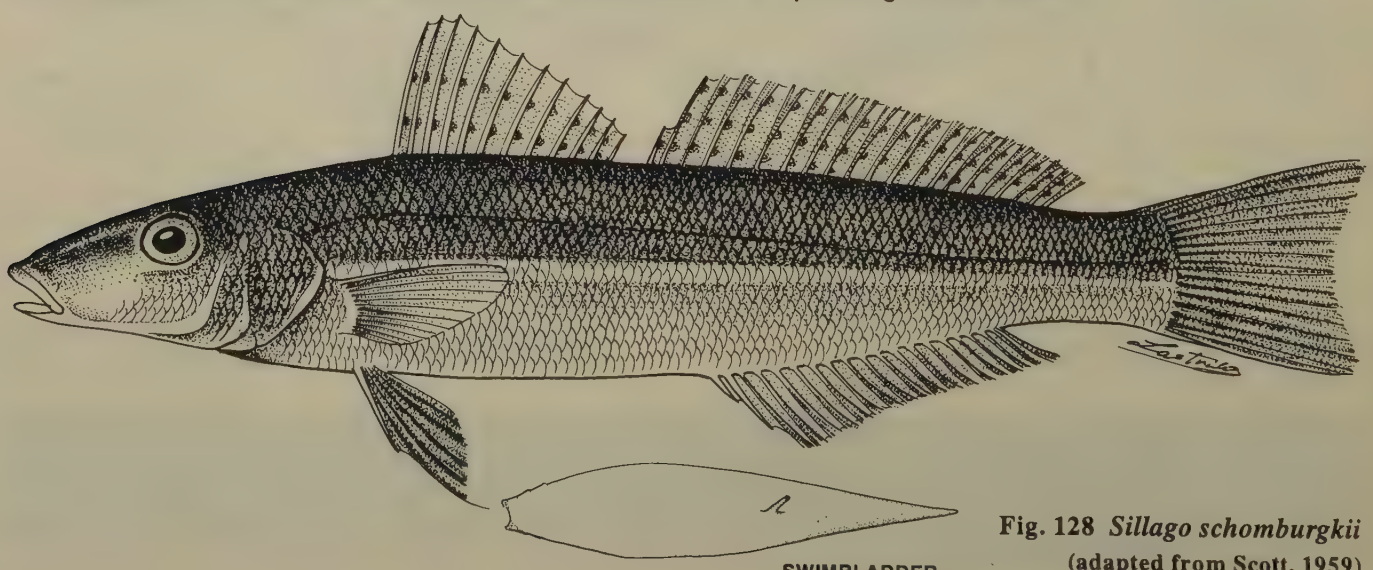


Fig. 128 ***Sillago schomburgkii*** **(adapted from Scott, 1959)**

Diagnostic Features: First dorsal fin with X to XII spines and second dorsal fin with I spine and 19 to 22 soft rays; anal fin with II spines and 17 to 20 soft rays. Lateral-line scales 66 to 76. Vertebrae: 16 or 17 abdominal + 8 to 11 modified + 10 to 13 caudal, total of 37. Swimbladder without a median anterior extension.

Geographical Distribution: Western Australia from Shark Bay southward along the southern coast of Australia to eastern South Australia. One unconfirmed report of this species from Exmouth Gulf, Western Australia (Fig. 129).

Fig. 129

Habitat and Biology: *Sillago schomburgkii* frequents inshore sand banks, bars and spits, and congregates in sandy hollows. It occurs in depths of 0 to 30 m. At high tide this species moves in schools across the sand flats and retreats to the slopes of the banks when the tide falls. It enters sandy estuaries in large schools, and may penetrate to the limit of the brackish water. At Mandurah and Leschenault Inlet, Western Australia, large schools appear during the summer months. The spawning season commences in September and is completed by January in Shark Bay (Lenanton 1969a). The juveniles frequent the shallows of protected bays and inlets and move into deeper water at maturity.

Size: To 41 cm total length.

Interest to Fisheries: Taken by seine in open bays and near estuaries. This species forms the basis for small fisheries. It has potential as an aquaculture species.

Local Names: AUSTRALIA: Yellowfin whiting.

Literature: Scott (1962:187-188, fig.); Whitley (1964:43); Lenanton (1969a:4-11, 1969b:5); Jones (1981:20-23}; Hutchins and Swainston (1966:col. pl. 269).

Sillago sihama (Forsskål, 1775) Fig. 130 SILL Sill 2

Atherina sihama Forsskål, 1775:70 (Lohaja, Red Sea).

Synonyms: *Platycephalus sihamus*: Bloch and Schneider, 1801:60. *Sciaena malabarica* Bloch and Schneider, 1801:81, pl. 19 (Tranquebar). *Sillago acuta* Cuvier, 1817:258 (Sea of the Indies). *Sillago erythraea* Cuvier, 1829:409 (Suez, Red Sea). *Sillago malabarica*: Cantor, 1849:1003. *Sillago ihama* (misprint) Fowler, 1928b:16.

FAO Names: **En** - Silver sillago; **Fr** - Pêche-madame argenté; **Sp** - Silago plateado.

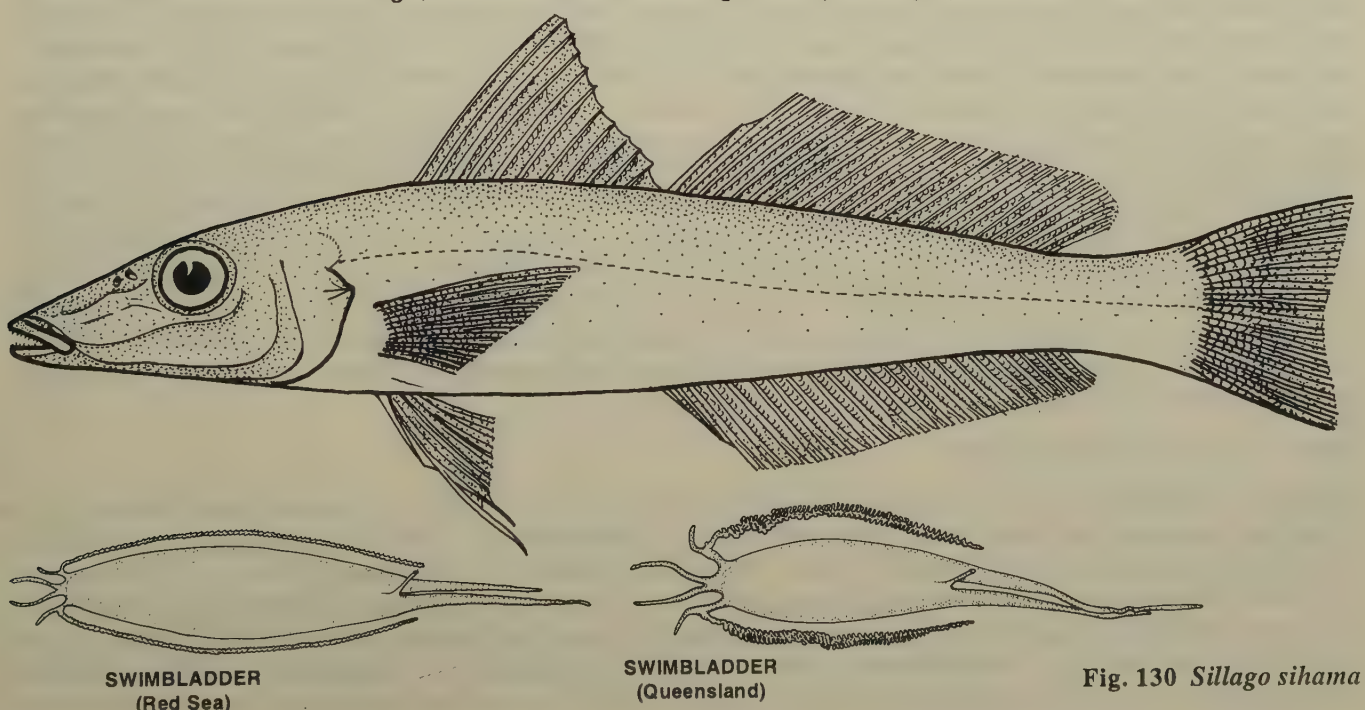


Fig. 130 *Sillago sihama*

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 20 to 23 soft rays; anal fin with II spines and 21 or 23 soft rays. Lateral-line scales 66 to 72. Vertebrae: 14 abdominal + 2 to 8 modified + 12 to 18 caudal, total of 34. Two posterior extensions to the swimbladder, two anterior extensions extend forward and diverge to terminate on each side of the basioccipital above the auditory capsule; two lateral extensions commence anteriorly, each sending a blind tubule anterolaterally and then extending along the abdominal wall below the investing peritoneum to just posterior of the duct-like process; two posterior tapering extensions of the swimbladder project into the caudal region, one usually longer than the other; the lateral extensions are normally convoluted and have blind tubules arising along their length. **Colour**: Body light tan, silvery yellow-brown, sandy brown, or honey coloured; paler brown to silvery white below; a midlateral, silvery, longitudinal stripe normally present; dorsal fins dusky terminally with or without rows of dark brown spots on the second dorsal-fin membrane; caudal fin dusky terminally; no dark blotch at the base of the pectoral fin; other fins hyaline, the anal fin frequently with a whitish margin. After long preservation the coloration may become a uniform light brown.

Geographical Distribution: A wide ranging species throughout the Indo-West Pacific region from Knysna, South Africa to Japan. Although ***Sillago sihama*** has been recorded from Japan by numerous authors (see *S. japonica*) it appears that many records refer to ***Sillago japonica***. The two species can be positively identified by reference to the swimbladder morphology, and the total vertebrae counts (33 in *S. sihama*, 34 in *S. japonica*). In Australia from Broome in the west to Townsville, Queensland (Fig. 131).

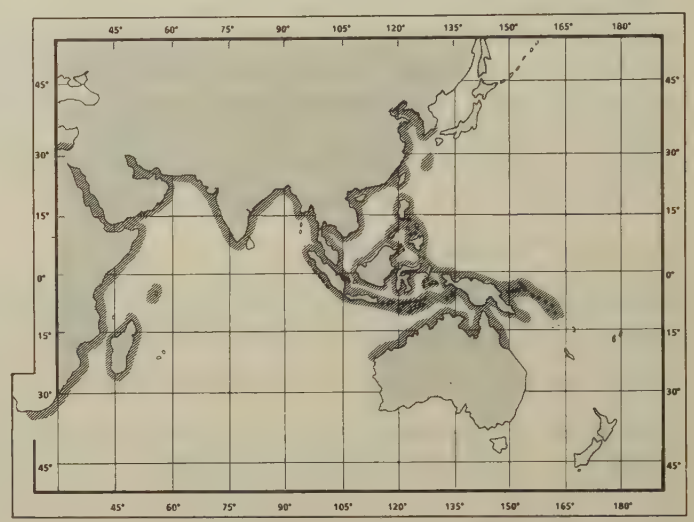


Fig. 131

Habitat and Biology: A nearshore species that frequently penetrates estuaries for considerable distances. The species has been recorded from freshwater by Günther (1861, p. 221) and Macleay (1883, p. 360), despite the absence of renal corpuscles or tubules in the kidney. It is common along the beaches, sandbars, mangrove creeks and estuaries; but very rarely captured by prawn trawling vessels. In depths ranging from 0 to 20 m (seldom 60 m). Like most members of the family, ***S. sihama*** may bury itself in the sand when danger approaches (Maxwell, 1921) and commonly avoids seine-nets by employing this behaviour. The principal items of diet are polychaete worms (*Marphysa, Perinereis, Nereis*), small prawns (*Penaeus*), other crustacea (*Ocypoda, Alpheus* and *Gonodactylus*), shrimps and amphipods (Chacko, 1949a, 1949b). Small fish are often taken and filamentous algae is consumed. Australian specimens frequently contain polychaete worms and small crustacea. The spawning season in India is November to March (Chacko, 1950) with advanced post-larvae appearing from December to February, reaching 25 mm by April (Gopinath, 1946). The growth is rapid, attaining sexual maturity at a length of 13 to 14 cm at about 1 year, 16 to 20 cm at 2 years, 20 to 24 cm at 3 years and 24 to 28 cm by 4 years of age. Growth rings on the otolith are clearly defined and it is possible to discern rings with the naked eye (Radhakrishnan, 1954). The egg is spherical, colourless and buoyant, 0.5 to 0.6 mm in diameter, and without a large oil globule. Palekar and Bal (1961) found numerous small oil globules that fused into a large single oil globule in the fully ripe ovum which measured from 0.57 to 0.80 mm. The presence of a single shining, translucent oil globule is characteristic of the mature ovum. Spawning takes place in the Kali river estuary during August to October and occurs only once during the season. Fecundity varied between 16 682 and 166 130. The size at first maturity is much larger (235 mm for females and 224 mm for males) than that reported by Radhakrishnan (1954) and the time of spawning is at variance with that reported by Chacko (1950). Accurate identification of ***S. sihama*** is of crucial importance in such studies. It has been shown that misidentification of this species, especially with ***S. japonica***, ***S. lutea*** and ***S. vincenti***, is widespread.

Size: To 30 cm standard length.

Interest to Fisheries: An important foodfish throughout its range. Taken by seine net and cast net in the mouths of estuaries and along coastal beaches in bays. Large schools are common in estuaries and fleets of canoes with cast net fishermen encircle the school and cast together or in rapid succession. As the fish burrow into the sand to escape the seine net children and women follow the hauled net and feel for the fish with the feet; the buried fish is captured by hand and dispatched by biting the fish behind the head or threaded by the gills on cord and toggle. Considerable catches are made but generally not reflected in the fishery statistics. In Pakistan the main fishery takes place in June to July. The catches reported range from 102 t (1980) to 859 t

(1982) with an average of 404 t (Bianchi, 1985). The species is recognised as a superior fish for invalids and children. For this reason it does not always appear in small markets and is rarely salted or dried. Recipes for cooking frequently include milk or coconut juice, the flesh being simmered or steamed rather than deep fried. When steamed the flesh is of delicate texture, flavour and of clean white appearance. It is a potential candidate for aquaculture.

Local Names: AUSTRALIA: Northern whiting, Sand smelt; JAPAN: Moto-gisu; MADAGASCAR: Amboso, Ambotso, Amborody, Ambotsoka, Toholava; PAKISTAN: Bhambor, Hashoor, Silver whiting; TANZANIA: Mtambaanchi, Tambanji, Sondo.

Literature: Rüppell (1828:9, pl. 3, fig. 1); Günther (1860:243, 1861:221, 1880:56); Gill (1861:504); Bleeker (1865:56, 1865:56, 1874:67, 1876:332, 1878:46); Day (1865a:18, 1865b:47-48, 1869:299, 1870:686, 1878:265, pl. 57, fig. 3); Schmeltz (1866:8, 1869:16, 1879:44); Playfair (1867:861); Klunzinger (1870:818, 1879:369, 1884:123); Peters (1877:836); Macleay (1883:360); Steindachner (1893:237); Rutter (1897:87); Jordan and Snyder (1901:109, 1902:486-487); Jordan and Evermann (1902:360); Johnstone (1903:295); Fowler (1904:549, 1925:248, 1927:286, 1928a:235, 1928b:709, 1930a:611, 1930b:654, 1931a:377, 1931b:302, 1933:417-421, 1934a:422, 1934b:422, 1935:150, 1937:238, 1939:50, 1949:50); Pellegrin (1905:83, 1907:203, 1914:225); Jordan and Seale (1905:782, 1907a:12, 1907b:25); Jordan and Starks (1905:205, 1917:455); Gilchrist and Thompson (1908:192, 1916:275, 1917:348); Regan (1908:245); Jordan and Richardson (1909:192); Jenkins (1910:132, 136); Seale (1910:281, 1914:69); Weber (1913:267); De Beaufort (1913:119); Jordan et al. (1913:187); Jordan and Metz (1913:41); Jordan and Thompson (1914:259); Maxwell (1921:33); Fowler and Bean (1922:68, 1927:8); Chaudhuri (1923:721); Hora (1924:489); Vinciguerra (1926:583); (?) Paradice and Whitley (1927:89); Barnard (1927:507-508); Reeves (1927:10); Whitley (1928:12, 1964:43); Mori (1928:6); Gudger (1929:528); Duncker and Mohr (1929:70); Weber and de Beaufort (1931:172-173, description, references, localities); Borodin (1932:85); Herre (1933:4, 1939:112, 1953:479-480); Martin and Montalban (1935:222-224); Umali (1934:371); Hardenberg (1936:246, 1941:227); Villadolid (1937:192); Blanco (1938:507); Domantay (1940:98); Gopinath (1942:337, 1946:13, 19); Chako (1949a:33, 1949b:95, 1950:171); Smith (1949:203, fig. 467, 1955:44); Suvatti (1950:395); Tripathy (1952:80, 84); Radhakrishnan (1954:196, 1957:254-283); Palekar and Bal (1955:128, 1961:76-93); Munro (1955:121, 1958:178, 1967:347); Tomiyama and Abe (1958:1176); Scott (1959:56); Menon (1961:387); Khalaf (1961:80); Smith and Bailey (1961:359); Misra (1962:232-233); Nadkarni (1963:164-166, kidneys); Smith and Smith (1963:18); Marshall (1964:170); Grant (1965:88, 1972:243); Alfred (1966:100); Arnoult and Fourmanoir (1967:137); Macnae and Kalk (1969:132); (?) Kakuda (1970:1-55, fishery); Kawamura et al. (1975:797, burrowing); Hiramoto (1976:14-20, aquarium spawning); Lee (1976:31-37, diet, Taiwan, 1981:361-363, eggs, Taiwan); Ramamurthy and Dhulkhed (1977:283-284); Mouneimne (1977, Sicily, Crete, first record); Kumai and Nakamura (1978:1055, spawning); James et al. (1978:212-220); Shao and Chang (1978:9, pl. 1, fig. 3, pl. 2, fig. 3, 1979:695-705); Dutt and Sujatha (1980:371-375); McKay (1980:381-382, fig. 1D, 1985:6-11, figs 2B, 6AB, 14A, 15); Krishnamurthy and Kaliyamurthy (1981:84-97, age and growth, Pulicat Lake, India); Lee, Hu and Hirano (1981:169-174, salinity, eggs and larval survival); Masuda et al. (1984:151, pl. 134-D); Sano and Mochizuki (1984:136-149, figs 1C, 5); James et al. (1984:313-324, larval resource, India); Lee and Hirano (1985:225-230, temp., photoperiod, spawning); Shao et al. (1986:147, distribution, swimbladder, Taiwan); Arshad (1986:238-239, distribution); Chervinski (1986:30-32, salinity tolerance); Yu and Chang (1986:127-130, spawning, 1987:227-229, culture); Allen and Swainston (1988:col. pl. 357); McKay and McCarthy (1989:551-553, fig. 3E-J, vertebrae, otoliths, Red Sea).

Remarks: Commonly confused with a number of uniform-coloured whiting species. All identifications must involve an examination of the swimbladder after careful removal of the dark brown or black peritoneum in addition to lateral-line scale and fin-ray counts. McKay and McCarthy (1989) describe the otoliths of two specimens from the Arabian Gulf and recognise this population to be genetically isolated from the Indo-West Pacific population. The swimbladder shape is slightly different in specimens taken from Queensland and the Red Sea (Fig. 130).

Sillago soringa Dutt and Sujatha, 1983 Fig. 132 SILL Sill 28

Sillago soringa Dutt and Sujatha, 1983:611-614 , fig. 1 .

Synonyms: None.

FAO Names: **En** - Soringa sillago; **Fr** - Pêche-madame soringa; **Sp** - Silago de Soringa.

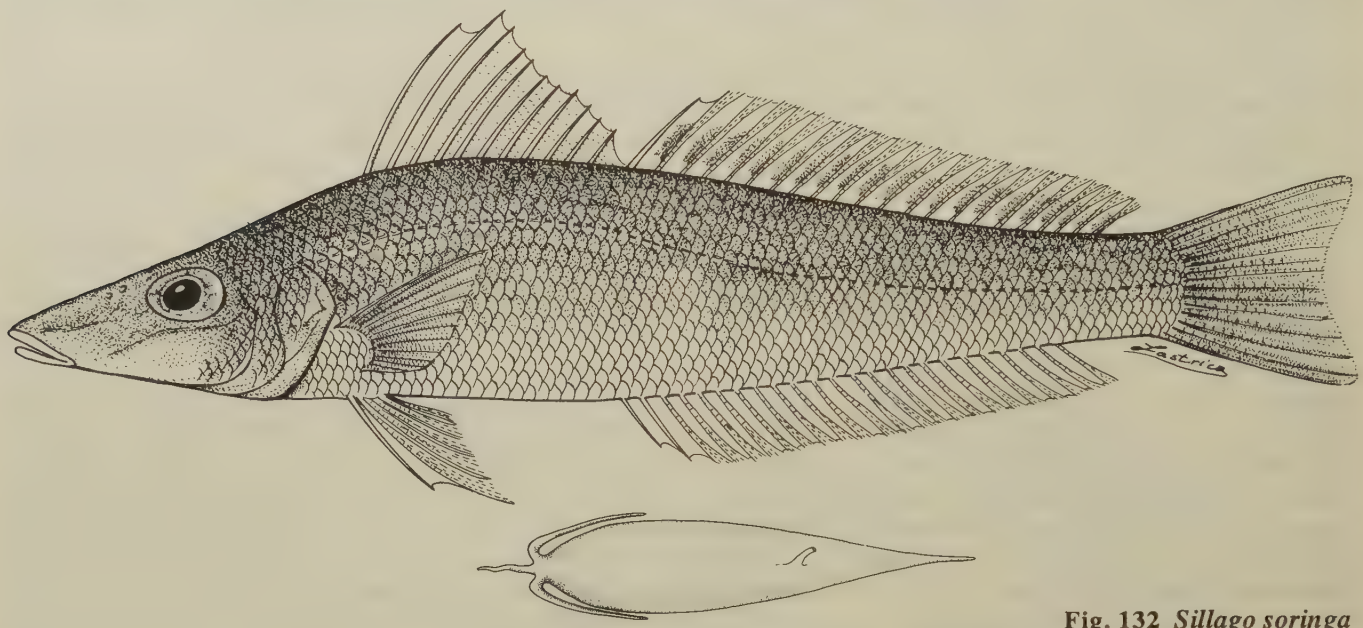


Fig. 132 ***Sillago soringa*** **(adapted from Dutt and Sujatha, 1982)**

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 21 soft rays; anal fin with II spines and 22 soft rays. Lateral-line scales 64 to 68. Vertebrae: total of 34. Swimbladder with three anterior extensions, the middle one projecting forward and the anterolateral ones recurved backward for a short distance along the sides; a single short posterior extension. **Colour**: Dorsal side and upper flanks grey brown, becoming paler laterally; lower flanks and ventral side milky white; spinous dorsal fin with minute discrete black dots on membrane; they are more numerous toward the distal half especially in the anterior half of the fin; in the soft dorsal fin is a more or less continuous grey band, running parallel to and close to the anterior edge of each ray; the membrane of the anal fin is also provided with minute black dots, but to a lesser extent than the spinous dorsal; pectoral fin and ventral fin hyaline with golden tinge; caudal fin hyaline, with fine black dots.

Geographical Distribution: East coast of India (Fig. 133).

Habitat and Biology: An inshore species related to sandy bottoms at 5 to 30 m depths.

Size: To 15 cm standard length.

Interest to Fisheries: Unknown.

Local Names: INDIA: Soringa.

Literature:

Remarks: Although Dutt and Sujatha (1983) regard their *S. soringa* as a distinct species, the close similarity to *S. asiatica* indicates that the latter species is a junior synonym of *S. soringa*. I retain both species pending a full study of the Indian material.

Fig. 133

Sillago vincenti McKay, 1980 | Fig. 134 | SILL Sill 4

Sillago vincenti McKay, 1980:378-381, fig. 1A-C (Kavanad near Neendakara, Kerala State, India).

Synonyms: None.

FAO Names: **En** - Vincent's sillago; **Fr** - Pêche-madame truité; **Sp** - Silago de Vincent.

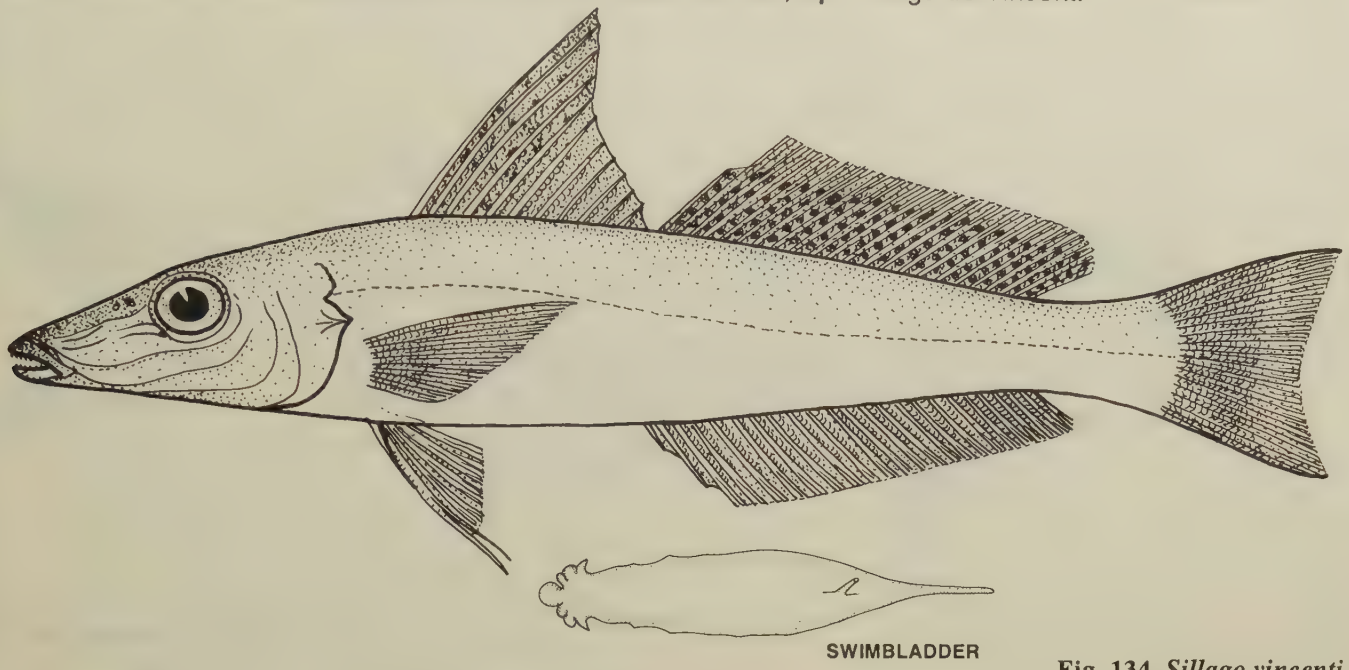


Fig. 134 ***Sillago vincenti***

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 21 to 23 soft rays; anal fin with II spines and 22 or 24 soft rays. Lateral-line scales 70 to 74. Vertebrae: 14 abdominal + 4 to 6 modified + 14 to 20 caudal, total of 34. Swimbladder with a single posterior extension, a short bulbous projection anteriorly with one to three anterolateral lobate or recurved projections; no tubular extensions anteriorly. **Colour**: Body uniform pale tan coloured, with the second dorsal fin spotted.

Geographical Distribution: East and west coast of India (Fig. 135).

Habitat and Biology: McKay (1980) reported females of 25 to 28 cm running ripe in late January to early February. It is caught in depths of 0 to 10 m and occurs with ***Sillago sihama*** apparently in mixed schools on muddy substrates.

Size: To 30 cm standard length.

Interest to Fisheries: Indian fishermen catch this species well into the estuaries. The species is recognised as having considerable potential for aquaculture in impoundments and tidal ponds. Growth is reported to be rapid.

Local Names: INDIA: Kalimeen.

Remarks: This species is very similar in external morphology to ***Sillago sihama***. A dissection of the posterior part of the swimbladder is required for field identification.

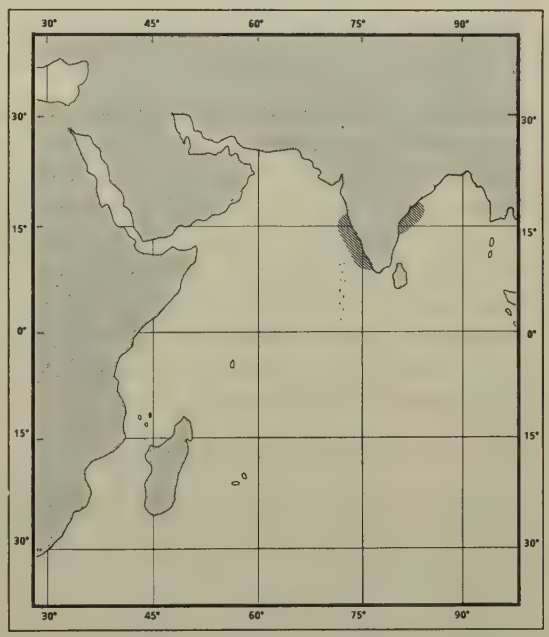


Fig. 135

Sillago vittata McKay, 1985 | Fig. 136 | SILL Sill 29

Sillago vittata McKay, 1985:20-22, figs 4B, 12B, 13E, 14C (Western Australia).

Synonyms: None.

FAO Names: **En** - Banded sillago; **Fr** - Pêche-madame rubonné; **Sp** - Silago bandeado.

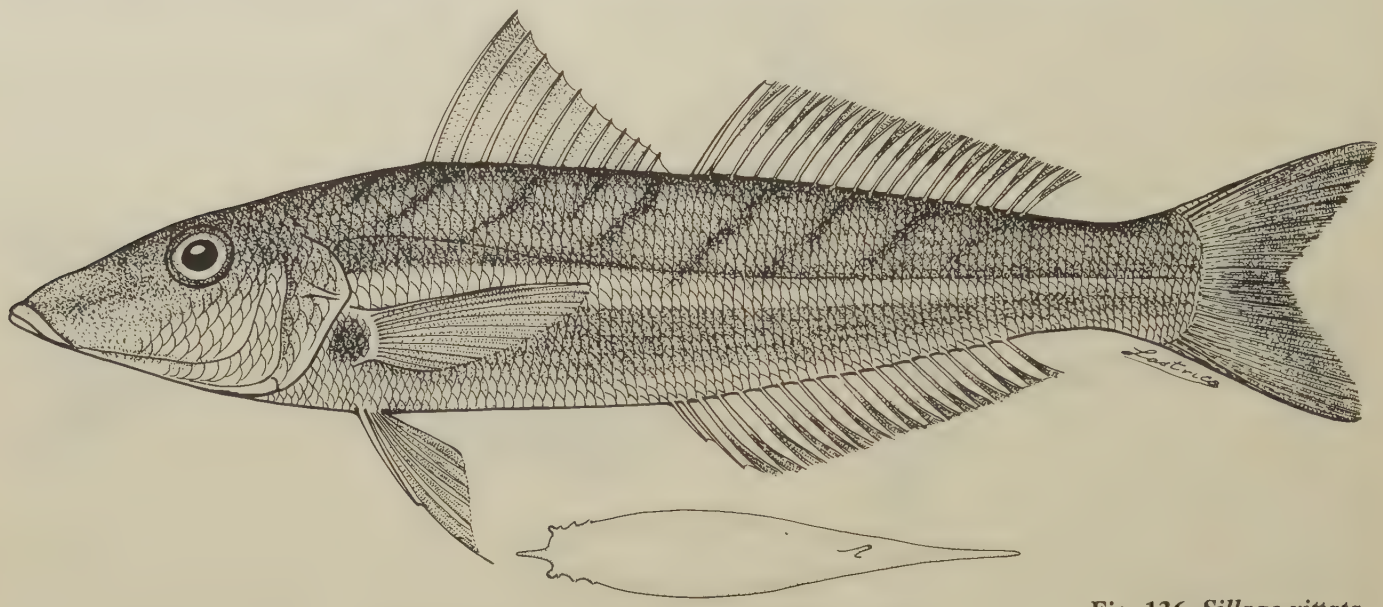


Fig. 136 *Sillago vittata*

Diagnostic Features: First dorsal fin with XI spines and second dorsal fin with I spine and 17 to 19 soft rays; anal fin with II spines and 16 or 18 soft rays. Lateral-line scales 65 to 70. Vertebrae: 13 or 14 abdominal + 8 to 12 modified + 7 to 10 caudal, total of 32 to 34. Swimbladder with a median anterior extension and very rudimentary anterolateral projections. **Colour**: Pectoral-fin base with a dusky spot, and body with 8 to 11, light brown to rusty brown very narrow bars extending from the back obliquely forward to touch or almost touch a conspicuous silvery midlateral longitudinal stripe.

Geographical Distribution: Maud Landing southward to Rottnest Island, Western Australia (Fig. 137).

Fig. 137

Habitat and Biology: This species is most common near weed banks and coral reefs in shallow-water and it is associated with *S. burrus*, *S. schomburgkii* and *S. analis*. It is known from depths between 20 and 55 m. At Maud Landing *S. vittata* may be taken by hook and line from the beach, but off Rottnest Island large catches may be taken by trawl net in 31 to 36 m where the species is in association with *S. robusta*, *S. bassensis*, and *S. burrus*. In southern waters *S. vittata* is not captured in shallow water.

Size: To 30 cm standard length.

Interest to Fisheries: A small fishery has developed on this species inside Shark Bay and off Rottnest Island, Western Australia. The flesh is of excellent quality.

Local Names: AUSTRALIA: Banded whiting, Bastard whiting, Golden whiting, Western school whiting.

Literature: Gloerfelt-Tarp and Kailola (1984:150, *Sillago* sp. 1); Hutchins and Swainston (1986:col. pl. 266); Allen and Swainston (1988: col. pl. 358).

Remarks: *Sillago vittata* may be separated from *Sillago burrus* by coloration, the morphology of the swimbladder, in having mostly ctenoid cheek scales, and by vertebrae counts.

3. LIST OF NOMINAL SPECIES OF SILLAGINIDAE

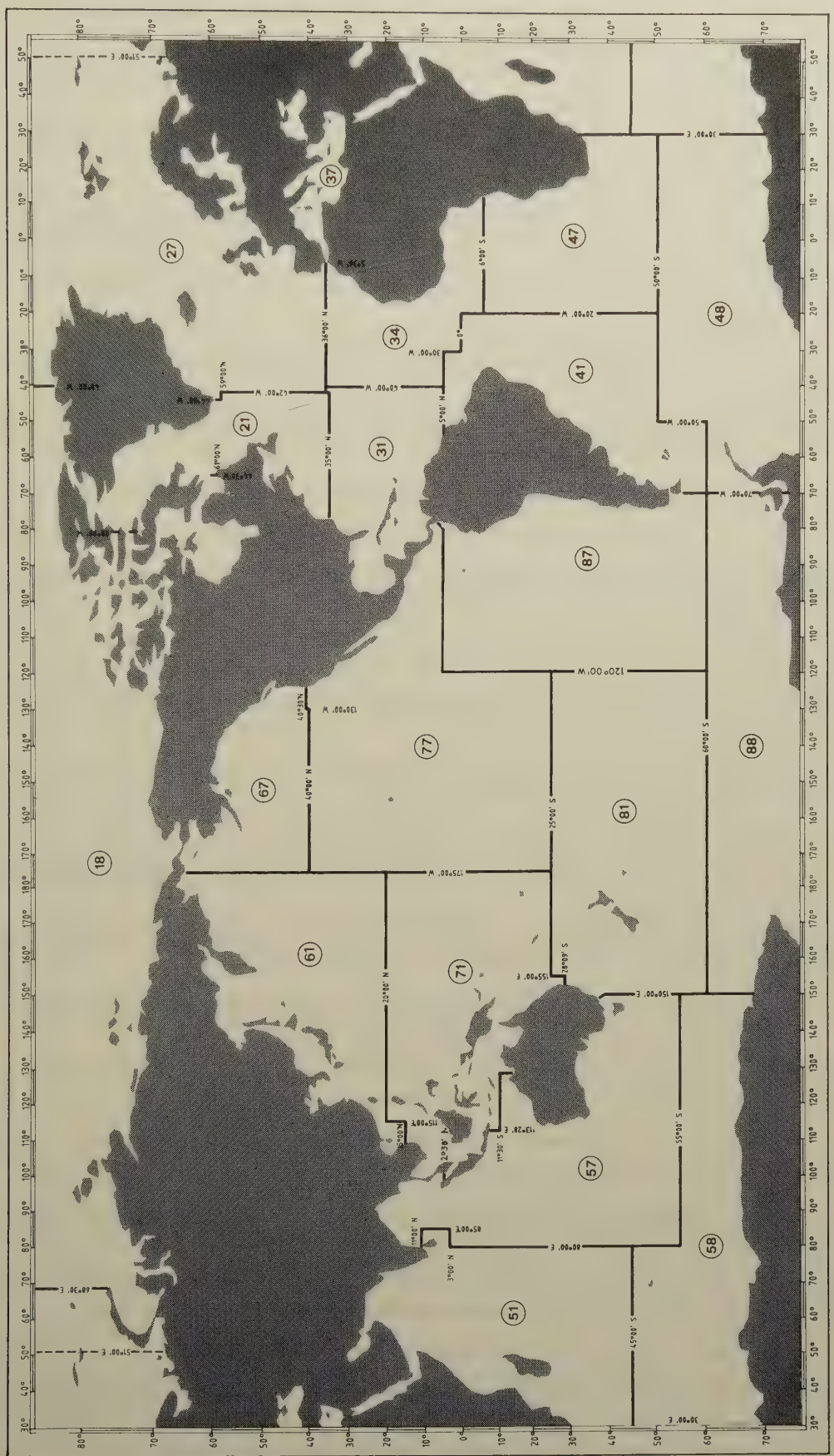
The following list gives in order (i) the scientific name as it originally appeared, in alphabetical order according to the specific name; (ii) the author(s) - Cuvier (1829) = in Cuvier and Valenciennes (1829); (iii) date of publication; and (iv) present identification.

Nominal Species	Present Identification
Sillago acuta Cuvier, 1817	*Sillago sihama*
Sillago aeolus Jordan and Evermann, 1902	*Sillago aeolus*
Sillago analis Whitley, 1943	*Sillago analis*
Sillago arabica McKay and McCarthy, 1989	*Sillago arabica*
Sillago argentifasciata Martin and Montalban, 1935	*Sillago argentifasciata*
Sillago asiatica McKay, 1983	*Sillago asiatica*
Sillago (Parasillago) attenuata McKay, 1985	*Sillago attenuata*
Sillago auricomis Ogilby, 1910	*Sillago robusta*
Sillago bassensis Cuvier, 1829	*Sillago bassensis*
Sillago (Parasillago) bassensis flindersi McKay, 1985	*Sillago flindersi*
Sillago bostockii Castelnau, 1873	*Sillago schomburgkii*
Sillago boutani Pellegrin, 1905	*Sillago boutani*
Sillago burrus Richardson, 1842	*Sillago burrus*
Sillago chondropus Bleeker, 1849	*Sillago chondropus*
Sillago ciliata Cuvier, 1829	*Sillago ciliata*
Sillago diadoi Thiolliére, 1857	*Sillago ciliata*
Sillago domina Cuvier, 1829	*Sillaginopsis panijus*
Sillago erythraea Cuvier, 1829	*Sillago sihama*
Sillago frazeri Whitley, 1944	*Sillago schomburgkii*
Sillago gracilis Alleyne and Macleay, 1877	*Sillago maculata*
Sillago (Parasillago) indica McKay, Dutt and Sujatha, 1985	*Sillago indica*
Sillago (Parasillago) ingenuua McKay, 1985	*Sillago ingenuua*
Sillago insularis Castelnau, 1873	*Sillago ciliata*
Sillago intermedius Wongratana, 1977	*Sillago intermedius*
Sillago japonica Temminck and Schlegel, 1843	*Sillago japonica*
Sillago (Parasillago) lutea McKay, 1985	*Sillago lutea*
Sillago macrolepis Bleeker, 1859	*Sillago macrolepis*
Isosillago maculata Macleay, 1879	*Sillaginodes punctata*
Sillago maculata Quoy and Gaimard, 1824	*Sillago maculata*
Sciaena malabarica Bloch and Schneider, 1801	*Sillago sihama*
Sillago megacephalus Lin, 1933	*? Sillago megacephalus*
Sillago (? Parasillago) microps McKay, 1985	*Sillago microps*
? Sillago nierstraszi Hardenberg, 1941	*Sillago nierstraszi*
Cheilodipterus panijus Hamilton-Buchanan, 1822	*Sillago panijus*
Sillago parvisquamis Gill, 1861	*Sillago parvisquamis*
Sillago punctata Cuvier, 1829	*Sillaginodes punctata*
Sillago robusta Stead, 1908	*Sillago robusta*
Sillago schomburgkii Peters, 1865	*Sillago schomburgkii*
Atherina sihama Forsskål, 1775	*Sillago sihama*
Sillago soringa Dutt and Sujatha, 1983	*Sillago soringa*
Sillago terra-reginae Castelnau, 1878	*Sillago ciliata*
Sillago vincenti McKay, 1980	*Sillago vincenti*
Sillago (Parasillago) vittata McKay, 1985	*Sillago vittata*

4. LIST OF SPECIES BY MAJOR FISHING AREAS

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION					
		MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES					
		47	51	57	61	71	81
Sillaginodes punctata	18			●			●
Sillaginopsis panijus	20			●		●	
Sillago aeolus	31		●	●	●	●	
Sillago analis	33			●		●	
Sillago arabica	35		●				
Sillago argentifasciata	36					●	
Sillago asiatica	37				●	●	
Sillago attenuata	38		●				
Sillago bassensis	39			●			
Sillago boutani	41				●		
Sillago burrus	42			●		●	
Sillago chondropus	44		●	●	●	●	
Sillago ciliata	45					●	●
Sillago flindersi	47			●			●
Sillago indica	49		●	●			
Silllago ingenuua	50			●	●	●	
Sillago intermedius	51		●	●		●	
Sillago japonica	52				●		
Sillago lutea	54		●	●		●	
Sillago macrolepis	56			●		●	
Sillago maculata	57					●	●
Sillago megacephalus	59				●		
Sillago microps	60				●		
Sillago nierstraszi	61					●	
Sillago parvisquamis	62				●		
Sillago robusta	63			●		●	●
Sillago schomburgkii	65			●			
Sillago sihama	67	●	●	●	●	●	
Sillago soringa	70			●			
Sillago vincenti	71		●	●			
Sillago vittata	72			●			

MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES



5. BIBLIOGRAPHY

Alfred, E.R. 1966. Observations on the fauna of Pulau Tioman and Pulau Tulai. 8. Fishes of the stream drainages. *Bull. Nat. Mus. Singapore*, 34:97-103.

Allen, G.R. and R. Swainston. 1988. *The Marine Fishes of North-Western Australia. A field guide for anglers and divers.* Western Australian Museum, Perth. 201 p.

Alleyne, H.G. and W.M. Macleay. 1877. The ichthyology of the Chevert Expedition. *Proc. Linn. Soc. N. S. W.*, 1:261-281, pls 3-4.

Arnoult, J. and P. Fourmanoir. 1967. Sur une collection de poissons marins et de reptiles provenant de l'île de Nossi-Bè (Madagascar). *Bull. Mus. Natl. Hist. Nat., Paris,* (2), 39(1):134-142.

Arshad, M. 1986. Occurrence and distribution of ladyfish along the Karachi coast. *Pakistan J. Agric. Res.*, 6(3):238-239.

Badham, C. 1916. On an ichthyobdellid parasitic on the Australian sand-whiting (*Sillago ciliata*). *Quart. J. Micro. Sci.,* (n.s.) 62:1-41.

Bailey, R.M. and W.A. Gosline. 1955. Variation and systematic significance of vertebral counts in the American fishes of the family Percidae. *Misc. Publ. Mus. Zool. Univ. Mich.,* 93:1-44.

Barlow, G.W. 1961. Causes and significance of morphological variation in fishes. *Syst. Zool.*, 10:105-117.

Barnard, K.H. 1927. A monograph of the marine fishes of South Africa. Part 2. *Ann. S. Afr. Mus.*, 21:419-1065.

Bauchot, M.-L. and G. Bianchi. 1984. *Fiches FAO d'identification des espèces pour les besoins de la pêche. Guide des poissons commerciaux de Madagascar (espèces marines et d'eaux saumâtres).* FAO, Rome. 135 p.

Bauchot, M.L., M. Desoutter and R.J. McKay. 1983. Catalogue critique des types de Poissons du Muséum national d'Histoire naturelle (Famille des Haemulidae et des Sillaginidae). *Bull. Mus. Natl. Hist. Nat., Paris*, (4)5A(2):27-61.

Beaufort, L.F. de. 1913. Fishes of the eastern part of the Indo-Australian Archipelago, with remarks on its zoogeography. *Bijdr. Dierk.*, 19:95-163.

Ben-Tuvia, A. 1986. Sillaginidae, p. 879-876. In: Whitehead, P.J.P., M.-L. Bauchot, J.-C. Hureau, J. Nielsen and E. Tortonese (eds.). *Fishes of the North-eastern Atlantic and the Mediterranean.* Vol. 2. Unesco, Paris. 494 p.

Bianchi, G. 1985. *FAO species identification sheets for fishery purposes. Field guide to the commercial marine and brackish-water species of Pakistan.* FAO, Rome. 200 p.

Bianchi, G. 1985. *FAO species identification sheets for fishery purposes. Field guide to the commercial marine and brackish-water species of Tanzania.* FAO, Rome. 199 p.

Blanco, G.J. 1938. Fisheries of northeastern Luzon and the Babuyan and Batanes Islands. *Philipp. J. Sci.*, 66:501-519.

Bleeker, P. 1845. Bijdragen tot de geneeskundige topographic van Batavia. Generische overzichte der fauna. *Nat. Geneesk. Arch. Ned. Indië*, 2:505-528.

Bleeker, P. 1849a. Bijdrage tot de kennis der Percoiden van den Malayo-Molukschen Archipel, met beschrijving van 22 nieuwe soorten. *Verh. Batav. Genoot. Kunst. Wet.*, 22:1-64.

Bleeker, P. 1949b. Bijdrage tot de kennis der ichthyologische fauna van het eiland Madura, met beschrijving van eenige nieuwe species. *Verh. Batav. Genoot. Kunst. Wet.*, 22:1-16.

Bleeker, P. 1853a. Nalezingen op de ichthyologie van Japan. *Verh. Batav. Genoot. Kunst. Wet.*, 25:1-56.

Bleeker, P. 1853b. Nalezingen op de ichthyologische fauna van Bengalen en Hindostan. *Verh. Batav. Genoot. Kunst. Wet.*, 25:1-164.

Bleeker, P. 1859. Derde bijdrage tot de kennis der ichthyologische fauna van Bali. *Nat. Tijdschr. Ned. Indië*, 17:141-175.

Bleeker, P. 1865. Notice sur les poissons envoyes de Chine au Musee de Leide par M.G. Schlegel. *Ned. Tijdschr. Dierk.*, 2:55-62.

Bleeker, P. 1874. Mémoire sur les Sciaenoides et les Sillaginoides de l'Inde archipelagique. *Verh. K. Akad. Wet. Amsterdam*, 14:1-76.

Bleeker, P. 1876. Systema Percarum revisum, part 2. *Arch. Néerl. Sci. Nat.*, 11:289-340.

Bleeker, P. 1877. *Atlas ichthyologique des Indes Orientales Néerlandaises, publié sous les auspices du gouvernement colonial Néerlandais. Vol. 8, Percoides 2 (Spariformes), Bogodoides, Cirrhiteoides.* Fréderic Muller, Amsterdam. 156 p., 41 pls.

Bleeker, P. 1878. Quartrième mémoire sur la faune ichthyologique de la Nouvelle-Guinée. *Arch. Néerl. Sci. Nat.*, 13:35-66.

Bleeker, P. 1879. Enumération des espèces de poissons actuellement connues du Japan et description de trois espèces inédites. *Verh. K. Akad. Wet. Amsterdam*, 18:1-33.

Bloch, M.E. and J.G. Schneider. 1801. M.E. Blochii Systema Ichthyologiae iconibus cx illustratum. Post obitum auctoris opus inchoatum absolvit, correxit, interpolavit J.G. Schneider, Saxo, Berolini. 584 p., 110 pls.

Boeseman, M. 1947. Revision of the fishes collected by Burger and von Siebold in Japan. *Zool. Meded., Leiden*, 28:1-242.

Borodin, N.A. 1932. Scientific results of the yacht "Alva" world cruise, July, 1931 to March, 1932, in command of William K. Vanderbilt. Fishes. *Bull. Vanderbilt Mar. Mus.*, 1:65-101.

Boulenger, G.A. 1887. An account of the fishes obtained by Surgeon-Major A.S.G. Jayakar at Muscat, east coast of Arabia. *Proc. Zool. Soc. London*, 1887:653-667.

Boulenger, G.A. 1901. Notes on the classification of teleostean fishes - 1. On the Trachinidae and their allies. *Ann. Mag. Nat. Hist.*, (7)8:261-271.

Brewer, D.T. and K. Warburton. 1988. A dietary study of *Sillago analis* and its variation in three Australian locations. *Proc. Linn. Soc. N. S. W.*, 110(2):215-217.

Brewer, D.T. and K. Warburton. 1992. Selection of prey from a seagrass/mangrove environment by golden lined whiting, *Sillago analis* (Whitley). *J. Fish Biol.*, 40: 257-271.

Burchmore, J.J., D.A. Pollard, M.J. Middleton, J.D. Bell and B.C. Pease. 1988. Biology of four species of whiting (Pisces: Sillaginidae) in Botany Bay, New South Wales. *Aust. J. Mar. Freshwat. Res.*, 39:709-727.

Cantor, T.E. 1849. Catalogue of Malayan fishes. *J. Asiat. Soc. Beng.*, 18(2):983-1443.

Castelnau, F.L. 1872. Contributions to the ichthyology of Australia. *Proc. Zool. Acclim. Soc. Victoria*, 1:29-247.

Castelnau, F.L. 1873. Contributions to the ichthyology of Australia. *Proc. Zool. Acclim. Soc. Victoria*, 2:37-158.

Castelnau, F.L. 1875. Researches on the fishes of Australia. *Intercol. Exhib. Essays*, 2:1-52.

Castelnau, F.L. 1878. Australian fishes. New or little known species. *Proc. Linn. Soc. N. S. W.*, 2:225-248.

Castelnau, F.L. 1879. Essay on the ichthyology of Port Jackson. *Proc. Linn. Soc. N. S. W.*, 3:347-402.

Chacko, P.I. 1949a. Nutrition of the young stages of estuarine fishes of Madras. *Sci. Cult.*, 15(1):32-33.

Chacko, P.I. 1949b. Food and feeding habits of the fishes of the Gulf of Manaar. *Proc. Indian Acad. Sci.*, 29(B):83-97.

Chacko, P.I. 1950. Marine plankton from waters around the Krusadai Islands. *Proc. Indian Acad. Sci.*, 31(B):162-174.

Chang, K.H. and C.P. Chen. 1974. The newly recorded sandborer *Sillago parvisquamis* Gill of Taiwan. *Bull. Inst. Zool. Acad. Sin.*, 13:35-36.

Chaudhuri, B.L. 1923. Fauna of the Chilka Lake. Fish Part IV. *Mem. Indian Mus.*, 5:711-736.

Chen, T.-W. and T.-C. Yu. 1982. Growth, environment, food and disease research of common whiting *Sillago japonica*. *Bull. Taiwan Fish. Res. Inst.*, 34:251-258.

Chervinski, J. 1986. Sand whiting, *Sillago sihama* Forsskål, Red Sea immigrant and its salinity tolerance. *Bamidgeh*, 38(1):30-32.

Cleland, K.W. 1947. Studies on the economic biology of the Sand Whiting (*Sillago ciliata*, C. & V.). *Proc. Linn. Soc. N. S. W.*, 72:215-228.

Cockerell, T.D.A. 1915. The scales of some Australian fishes. *Mem. Queensland Mus.*, 3:35-46.

Cohen, P. 1892. *The marine fish and fisheries of New South Wales, past and present, in their commercial aspect.* Government Printer, Sydney. 30 p.

Collette, B.B. 1974. The garfishes (Hemiramphidae) of Australia and New Zealand. *Rec. Aust. Mus.*, 29(2):11-105, figs 1-23.

Cuvier, G. 1817. *Le règne animal distribué d'après son organisation, pour servir de base à l'histoire naturelle des animaux et d'introduction a l'anatomie comparée.* Poissons, Vol. 2. Paris. 532 p.

Cuvier, G. 1829. *Le règne animal distribué d'après son organisation, pour servir de base à l'histoire naturelle des animaux et d'introduction a l'anatomie comparée.* Poissons, Vol. 2, p. 122-406. Deterville, Paris. Nouvelle édition.

Cuvier, G. and A. Valenciennes. 1829. *Histoire naturelle des poissons.* Vol. 3. F.G. Levrault, Paris. 500 p.

Day, F. 1865a. On the fishes of Cochin, on the Malabar coast of India. *Proc. Zool. Soc. London*, 1865:2-40.

Day, F. 1865b. *The fishes of Malabar.* B. Quaritch, London. 293 p.

Day, F. 1869. On the fishes of Orissa. *Proc. Zool. Soc. London*, 1869:296-310.

Day, F. 1870. On the fishes of the Andaman Islands. *Proc. Zool. Soc. London*, 1870:677-705.

Day, F. 1875-1878. *The fishes of India; being a natural history of the fishes known to inhabit the seas and fresh waters of India, Burma, and Ceylon.* Vol. 1. B. Quaritch, London. 778 p.

Day, F. 1888. *The fishes of India; being a natural history of the fishes known to inhabit the seas and fresh waters of India, Burma, and Ceylon.* Fishes of India, Supplement, October, 1888:779-816. B. Quaritch, London.

Devanesan, D.W. and K. Chidambaram. 1948. *The common food fishes of the Madras Presidency.* Dept. Indust. and Commerce, Madras. 79 p. Reference not seen.

Dixon, P.I., R.H. Crozier, M. Black and A. Church. 1987. *Stock identification and discrimination of commercially important whitings in Australian waters using genetic criteria (FIRTA 83/16).* Centre for Marine Science, University of New South Wales. 69 p. Appendices 1-10.

Domantay, J.S. 1940. The fishery industries of Zamboanga. *Philipp. J. Sci.*, 71:81-109.

Dredge, M.C.L. 1976. *Aspects of the ecology of three estuarine dwelling fish in southeast Queensland.* M. Sc. Thesis Univ. Queensland.

Duncker, G. and E. Mohr. 1931. Die Fische der Südsee - Expedition der Hamburgischen Wissenschaftlichen Stiftung 1908-1909. 3 Teil. *Mitt. Zool. St. Inst. Hamburg*, 44:57-84.

Dutt, S. and K. Sujatha. 1980. On the seven species of the family Sillaginidae from Indian waters. *Mahasagar - Bull. Nat. Inst. Oceanogr.*, 13(4):371-375.

Dutt, S. and K. Sujatha. 1983. On a new species of *Sillago* Cuvier, 1817 (Teleostei : Sillaginidae) from India. *Proc. Indian Natl. Sci. Acad.*, B48(5):611-614 (1982).

Evermann, B.W. and A. Seale. 1907. Fishes of the Philippine Islands. *Bull. Bur. Fish. Wash.*, 26:49-110.

FAO. 1992. Year book of Fishery Statistics, 1990. Catches and landings (Vol. 70). *FAO Statistics Series, No. 105.*

Forsskål, P. 1775. *Descriptiones animalium; avium, amphibiorum, piscium, insectorum, vermium; quae in itinere orientali observavit Petrus Forskal - Hauniae.* Post mortem auctoris edidit Carsten Niebuhr, Copenhagen. 164 p.

Fowler, H.W. 1904. A collection of fishes from Sumatra. *J. Acad. Nat. Sci. Philad.*, (2)12:495-560.

Fowler, H.W. 1925. Fishes from Natal, Zululand, and Portuguese East Africa. *Proc. Acad. Nat. Sci. Philad.*, 77:187-268.

Fowler, H.W. 1927. Notes on the Philippine fishes in the collection of the Academy. *Proc. Acad. Nat. Sci. Philad.*, 79:255-297.

Fowler, H.W. 1928a. The fishes of Oceania. *Mem. Bernice P. Bishop Mus.*, 10:1-540.

Fowler, H.W. 1928b. Notes and descriptions of fishes from Ceylon. *J. Bombay Nat. Hist. Soc.*, 32(4):704-710.

Fowler, H.W. 1928c. Further notes and descriptions of Bombay shore fishes. *J. Bombay Nat. Hist. Soc.*, 33(1):100-119.

Fowler, H.W. 1930a. Notes on Japanese and Chinese fishes. *Proc. Acad. Nat. Sci. Philad.*, 81: 589-616.

Fowler, H.W. 1930b. Notes on percoid and related fishes. *Proc. Acad. Nat. Sci. Philad.*, 81:633-657.

Fowler, H.W. 1931a. The fishes of Oceania - Supplement 1. *Mem. Bernice P. Bishop Mus.*, 11:313-381.

Fowler, H.W. 1931b. Studies of Hong Kong fishes. No. 2. *Hong Kong Nat.*, 2:287-317.

Fowler, H.W. 1933. Contributions to the biology of the Philippine Archipelago and adjacent regions. The fishes of the families Banjosidae, Lethrinidae, Sparidae, Girellidae, Kyphosidae, Oplegnathidae, Gerridae, Mullidae, Emmelichthyidae, Sciaenidae, Sillaginidae, Arripidae and Enoplosidae, collected by the United States Bureau of Fisheries Steamer "Albatross", chiefly in Philippine Seas and adjacent waters. *Bull. U. S. Natl. Mus.*, 100(12):1-465.

Fowler, H.W. 1934a. Fishes obtained by Mr H.W. Bell - Marley chiefly in Natal and Zululand in 1929 to 1932. *Proc. Acad. Nat. Sci. Philad.*, 86:405-514.

Fowler, H.W. 1934b. The fishes of Oceania - Supplement 2. *Mem. Bernice P. Bishop Mus.*, 11:385-466.

Fowler, H.W. 1935. Zoological results of the third De Schauensee Siamese Expedition. Part VI - Fishes obtained in 1934. *Proc. Acad. Nat. Sci. Philad.*, 87:89-163.

Fowler, H.W. 1937. Zoological results of the third De Schauensee Siamese Expedition. Part VIII - Fishes obtained in 1936. *Proc. Acad. Nat. Sci. Philad.*, 89:125-264.

Fowler, H.W. 1939. Zoological results of the third De Schauensee Siamese Expedition. Part IX - Additional fishes obtained in 1939. *Proc. Acad. Nat. Sci. Philad.*, 91:39-96.

Fowler, H.W. 1949a. A synopsis of the fishes of China. - Part VII cont. The Perch-like fishes. *J. Hong Kong Fish. Res. Stn.*, 2:3-65.

Fowler, H.W. 1949b. The fishes of Oceania - Supplement 3. *Mem. Bernice P. Bishop Mus.*, 12:37-186.

Fowler, H.W. 1953. Australian fishes obtained or observed by the United States Exploring Expedition, 1838-1841. *Ichthyol. Notes Queensland,* 2:11-20.

Fowler, H.W. and B.A. Bean. 1922. Fishes from Formosa and the Philippine Islands. *Proc. U. S. Natl. Mus.*, 62(2):1-73.

Fowler, H.W. and B.A. Bean. 1927. Notes on fishes obtained in Sumatra, Java, and Tahiti. *Proc. U. S. Natl. Mus.*, 71(10):1-15.

Fowler, J.A. 1970. Control of vertebral number in teleosts - an embryological problem. *Q. Rev. Biol.*, 45:148-167.

Frost, G.A. 1927. A comparative study of the otoliths of the Neopterygian fishes. *Ann. Mag. Nat. Hist.*, (9)20:298-305.

Gilchrist, J.D.F. and W.W. Thompson. 1908. Descriptions of fishes from the coast of Natal. *Ann. S. Afr. Mus.*, 6:145-206.

Gilchrist, J.D.F. and W.W. Thompson. 1916. A catalogue of the sea fishes recorded from Natal, Part 1. *Ann. Durban Mus.*, 1:255-290.

Gilchrist, J.D.F. and W.W. Thompson. 1917. A catalogue of the sea fishes recorded from Natal, Part 2. *Ann. Durban Mus.*, 1:291-431.

Gill, T.N. 1861. Description of a new species of *Sillago*. *Proc. Acad. Nat. Sci. Philad.*, 1861:505-507.

Gill, T.N. 1862a. Synopsis of the Sillaginoids. *Proc. Acad. Nat. Sci. Philad.*, 1861:501-505.

Gill, T.N. 1862b. Synopsis of the Notothenioids. *Proc. Acad. Nat. Sci. Philad.*, 1861:512-522.

Gloerfelt-Tarp, T. and P.J. Kailola. 1984. *Trawled fishes of southern Indonesia and northwestern Australia.* Australian Development Assistance Bureau, Australia, Directorate General of Fisheries, Indonesia, German Agency for Technical Cooperation, Germany. 406 p.

Goodall, J.A., A.W. Blackshaw and M.F. Capra. 1989. Factors affecting the activation and duration of motility of the spermatozoa of the summer whiting (*Sillago ciliata*). *Aquaculture,* 77(2-3): 243-250.

Goodall, J.A., M.F. Capra and A.W. Blackshaw. 1987. Quantitative histology of the seasonal changes in the gonads of summer whiting, *Sillago ciliata*. *J. Fish Biol.*, 30(5):589-595.

Gopinath, K. 1942. Distribution and feeding of the post-larval fishes of the Trivandrum coast. *Curr. Sci.*, 11(8):337-338.

Gopinath, K. 1946. Notes on the larval and postlarval stages of fishes found along the Trivandrum coast. *Proc. Natl. Inst. Sci. India*, 12(1):7-21.

Grant, E.M. 1965. Guide to fishes. *Fishes. Notes Queensland*, 2(2):1-280.

Grant, E.M. 1972. *Guide to Fishes*. Press Etching Pty. Ltd, Brisbane. 472 p.

Gudger, E.W. 1929. Nicholas Pike and his unpublished paintings of the fishes of Mauritius, Western Indian Ocean, with an index to the fishes. *Bull. Am. Mus. Nat. Hist.*, 58:489-530.

Gunn, J.S. and N.E. Milward. 1985. The food, feeding habits and feeding structures of the whiting species *Sillago sihama* (Forsskål) and *Sillago analis* Whitley from Townsville, North Queensland, Australia. *J. Fish Biol.*, 26:411-427.

Günther, A. 1860. *Catalogue of the acanthopterygian fishes in the collection of the British Museum.* Vol. 2. British Museum, London. 548 p.

Günther, A. 1861. List of the cold-blooded Vertebrata collected by B.H. Hodgson, Esq., in Nepal. *Proc. Zool. Soc. London*, 1861:213-227.

Günther, A. 1880. Report on the shore fishes procured during the voyage of H.M.S. "Challenger" in the years 1873-1876. *Rep. Scient. Results Voy. Challenger,* 1(6):1-82.

Hamilton-Buchanan, F. 1822. *An account of the fishes found in the River Ganges and its branches.* Archibald Constable and Company, Edinburgh and London. 405 p.

Hardenberg, J.D.F. 1936. On a collection of fishes from the estuary and the lower and middle course of the river Kapuas (W. Borneo). *Treubia*, 15:225-254.

Hardenberg, J.D.F. 1941. Fishes of New Guinea. *Treubia*, 18:217-231.

Haysom, N.M. 1957. Notes on some Queensland fishes. *Ichthyol. Notes Queensland*, 1:139-144.

Herre, A.W. 1933. A check list of fishes from Sandakan, British North Borneo. *J. Pan-Pacif. Res. Instn.*, 8(4):2-11.

Herre, A.W. 1939. On a third collection of fish from Maungmagan, Tavoy district, lower Burma. *Rec. Indian Mus.*, 41:111-116.

Herre, A.W. 1945. Marine fishes from the Chusan Archipelago and the Chinese coast. *Lingnan Sci. J.*, 21:107-122.

Herre, A.W. 1953. Check list of Philippine fishes. *Res. Rep. U. S. Fish Wildl. Serv.*, 20:1-977.

Hirai, A. 1988. Fine structure of the micropiles of pelagic eggs of some marine fishes. *Jap. J. Ichthyol.*, 35(3):351-357.

Hiramoto, Y. 1976. Studies on the artificial reproduction of the sand borer, *Sillago sihama* (Forsskål) - 1. Spawning of the sand borer cultured in an aquarium. *Aquiculture*, 24(1):14-20.

Hollister, G. 1934. Clearing and drying fish for bone study. *Zoologica*, 12:89-101.

Hoque, B. and R.W.R. Patra. 1987. Fecundity of the ladyfish, *Sillago domina* (Cuvier) (Trachinidae: Perciformes). *Bangladesh J. Zool.*, 15(2):205-210.

Hora, S.L. 1924. Fish of the Tale Sap, Peninsula Siam. *Mem. Asiat. Soc. Beng.*, 6:479-503. Reference not seen.

Hotta, H. 1961. *Comparative study of the axial skeleton of Japanese Teleostei.* Nippon Gyogaku Shinkokai, Tokyo. 151 p., 69 pls, 207 figs. (In Japanese).

Hutchins, B. and R. Swainston. 1986. *Sea Fishes of Southern Australia. Complete field guide for anglers and divers.* Swainston Publishing, Perth. 180 p.

James, P.S.B.R., T.J. Verghese and K.V. Devaru. 1978. Some observations on the possibilities of culture of the Indian Sand whiting *Sillago sihama* (Forsskål) in brackish waters. *J. Inland Fish. Soc. India*, 8:212-220.

James, P.S.B.R., R. Soundararajan and J.X. Rodrigo. 1984. A study of the seed resource of the Indian sand whiting *Sillago sihama* (Forsskål) in the Palk Bay. *Indian J. Fish.*, 31(3):313-324.

Jenkins, J.T. 1910. Notes on fish from India and Persia, with descriptions of new species. *Rec. Indian Mus.*, 5:123-140.

Johnston, R.M. 1883. General and critical observations on the fishes of Tasmania; with a classified catalogue of all the known species. *Pap. Proc. R. Soc. Tasmania*, 1882:53-144.

Johnston, R.M. 1891. Further observations upon the fishes and fishing industries of Tasmania, together with a revised list of indigenous species. *Pap. Proc. R. Soc. Tasmania*, 1890:22-46.

Johnston, R.M. 1903. Report on the marine fishes (collected by Messrs. Annandale and Robinson on the coast of Patani and Thering). *Fasc. malayenses.*, 2:293-302. Reference not seen.

Jones, J.K. 1980. Research on the biology of spotted (King George) whiting in South Australian waters. *Safish*, 4(1):3-7.

Jones, J.K. 1981. Yellowfin whiting (*Sillago schomburgkii*) studies in South Australian waters. *Safish*, 5(4):20-23.

Jones, G.K., D.A. Hall, K.L. Hill and A.J. Staniford. 1989. Stock Assessment, Economics, Management. In: *The South Australian Marine Scalefish Fishery.* South Australian Department of Fisheries, Green Paper. 186 p.

Jordan, D.S. and B.W. Evermann. 1902. Notes on a collection of fishes from the island of Formosa. *Proc. U. S. Natl. Mus.*, 25:315-368.

Jordan, D.S. and C.L. Hubbs. 1925. Record of fishes obtained by David Starr Jordan in Japan, 1922. *Mem. Carnegie Mus.*, 10:93-336, pls 5-12.

Jordan, D.S. and C.W. Metz. 1913. A catalog of the fishes known from the waters of Korea. *Mem. Carnegie Mus.*, 6:1-65, pls 1-10.

Jordan, D.S. and R.E. Richardson. 1909. A catalog of the fishes of the island of Formosa, or Taiwan, based on the collections of Dr Hans Sauter. *Mem. Carnegie Mus.*, 4:159-204.

Jordan, D.S. and A. Seale. 1905. List of fishes collected by Dr Bashford Dean on the island of Negros, Philippines. *Proc. U. S. Natl. Mus.*, 28:769-803.

Jordan, D.S. and A. Seale. 1907a. Fishes of the islands of Luzon and Panay. *Bull. Bur. Fish. Wash.*, 26:1-48.

Jordan, D.S. and A. Seale. 1907b. List of fishes collected at Hong Kong by Captain Williams Finch, with descriptions of five new species. *Proc. Davenport Acad. Sci.*, 10:1-17.

Jordan, D.S. and J.O. Snyder. 1901. A preliminary check list of the fishes of Japan. *Annotnes Zool. Jap.*, 3:31-159.

Jordan, D.S. and J.O. Snyder. 1902. A review of the Trachinoid fishes and their supposed allies found in the waters of Japan. *Proc. U. S. Natl. Mus.*, 24:461-497.

Jordan, D.S. and E.C. Starks. 1905. On a collection of fishes made in Korea, by Pierre Louis Jouy, with descriptions of new species. *Proc. U. S. Natl. Mus.*, 28:193-212.

Jordan, D.S. and E.C. Starks. 1917. Notes on a collection of fishes from Ceylon with descriptions of new species. *Ann. Carnegie Mus.*, 11:430-460.

Jordan, D.S., S. Tanaka and J.O. Snyder. 1913. A Catalogue of the fishes of Japan. *J. Coll. Sci. Imp. Univ. Tokyo*, 33:1-497.

Jordan, D.S. and W.F. Thompson. 1914. Record of the fishes obtained in Japan in 1911. *Mem. Carnegie Mus.*, 6:205-313.

Jouan, H. 1861. Notes sur quelques espèces de poissons de la Nouvelle-Caledonie. *Mem. Soc. Imp. Sci. Nat. Cherbourg, 8:241-308. Reference not seen.*

Kakuda, S. 1970. Studies on the ecology and fishing stock of *Sillago sihama* (Forsskål) through the analysis of its bottom drift-net fishery. *J. Fac. Fish. Anim. Husb. Hiroshima Univ.*, 9:1-55.

Kashiwagi, M., H. Sakaki, T. Takahashi and T. Iwai. 1987. A relationship between egg size and hatching rate in Japanese whiting *Sillago japonica*. *Bull. Jap. Soc. Scient. Fish.*, 53(12): 2105-2110.

Kawamura, G., A. Shinomiya and H. Kaminokado. 1975. On the burrowing behaviour of *Sillago sihama* (Forsskål) observed directly. *Bull. Jap. Soc. Scient. Fish.*, 41(7):797.

Kawanabe, H., Y.T. Saito, T. Sunaga, I. Maki and M. Azuma. 1968. Ecology and biological production of Lake Naka-umi and adjacent regions. 4. Distribution of fishes and their foods. *Spec. Publs. Seto. Mar. Biol. Lab.*, (11)2(4/5):45-73.

Kent, W. Saville. 1893. *The Great Barrier Reef of Australia: Its products and potentialities*. W.H. Allen, London. 388 p., 16 chromo-pls, 48 photo-pls.

Khalaf, K.T. 1961. *The marine and freshwater fishes of Iraq*. Ar-Rabitta Press, Baghdad. 164 p.

Klausewitz, W. and J.G. Nielsen. 1965. On Forsskål's collection of fishes in the Zoological Museum of Copenhagen. *Spolia Zool. Mus. Haun.*, 22:1-29, pls 1-38.

Klunzinger, C.B. 1870. Synopsis der Fische des Rothen Meeres. *Verh. Zool.-Bot. Ges. Wien*, 20:669-834.

Klunzinger, C.B. 1879. Die V. Müller'sche Sammlung australischer Fische in Stuttgart. *Sitzungsber. Österr. Akad. Wiss. Wien*, 80:325-430.

Klunzinger, C.B. 1884. *Die Fische des Rothen Meeres. Eine kritische Revision mit Bestimmungstabellen. I. Acantopteri veri*. E. Schweizerbart'sche, Stuttgart. 133 p.

Kner, R. 1865-1867. Fische. Vol. 1-3. In: *Reise der österreichischen Fregatte "Novara" um die Erde in den Jahren 1857-1859, unter den Befehlen des Commodore B. von Wüllerstorf - Urbain*. Zoologischer Theil. Wien. 433 p., pls 1-16.

Kobayashi, M., K. Aida, K. Furukawa, Yean Kok Law, T. Moriwaki and I. Hanyu. 1988. Development of sensitivity to maturation-inducing steroids in the oocytes of the daily spawning teleost, the kisu *Sillago japonica*. *Gen. Comp. Endocrinol.*, 72(2):264-271.

Krishnamurthy, K.N. 1969. Observations on the food of the sand whiting *Sillago sihama* (Forsskål) from Pulicat Lake. *J. Mar. Biol. Assoc. India*, 11:295-303.

Krishnamurthy, K.N. and M. Kaliyamurthy. 1981. Studies on the age and growth of sand whiting *Sillago sihama* (Forsskål) from Pulicat Lake with observations on its biology and fishery. *Indian J. Fish.*, 25(1-2):84-97.

Krishnayya, C.G. 1963. On the use of otoliths in the determination of age and growth of the Gangetic whiting, *Sillago panijus* (Ham.Buch.), with notes on its fishery in Hooghly estuary. *Indian J. Fish.*, 10:391-412.

Krishnayya, C.G. 1968. On the use of otoliths in the determination of age and growth of the Gangetic whiting, *Sillago panijus* (Ham.Buch.), with notes on its fishery in Hooghly Estuary. *Indian J. Fish.*, 10 A, 1963:129-147, 10 figs.

Kumai, H. and M. Nakamura. 1978. Spawning of the silver whiting *Sillago sihama* (Forsskål) cultivated in the laboratory. *Bull. Jap. Soc. Scient. Fish.*, 44(9):1055.

Kurahawa, A. and S. Suzuki. 1983. Relationships between feeding habits of fish larvae and their food organisms in the western Wakasa Bay. *Bull. Jap. Soc. Scient. Fish.*, 49(10):1507-1513.

Lacepède, B.G. 1803. *Histoire naturelle des poissons.* Vol. 5. Plassen, Paris. 803 p.

Ladiges, W., G. von Wahlert and E. Mohr. 1958. Die Typen und Typoide der Fischsammlung des Hamburgischen Zoologischen Museums. *Mitt. Hamb. Zool. Mus. Inst.*, 6:155-167.

Lanzing, W.J.R. 1967. The saccus vasculosus of the tuna brain. *Copeia.*, No. 1:241-242.

Lanzing, W.J.R. and J.S. Hynd. 1967. Tetracycline distribution in body tissues of marine fishes. *Aust. J. Sci.*, 29:177-178.

Last, P.R., E.O.G. Scott and F.H. Talbot. 1983. *Fishes of Tasmania.* Tasmanian Fisheries Development Authority, Tasmania. 563 p.

Lee, S.-C. 1976. Diet of juvenile *Sillago sihama* (Forsskål) from inshore waters near Hsinchu, Taiwan. *Bull. Inst. Zool. Acad. Sin.*, 15(2):31-37.

Lee, S.-C. 1981. Factors affecting egg characteristics in the fish *Sillago sihama*. *Marine Ecol. (Prog. Ser.)*, 4(3):361-363.

Lee, S.-C. and R. Hirano. 1985. Effects of water temperature and photoperiod on the spawning cycle of the sand borer, *Sillago sihama*. *Prog. Fish-Cult.*, 47(4):225-230.

Lee, S.-C., F. Hu and R. Hirano. 1981. Salinity tolerance of fertilized eggs and larval survival in the fish *Sillago sihama*. *Marine Ecol. (Prog. Ser.)*, 4(2):169-174.

Legand, M. 1952. Étude de la croissance postlarvaire de *Sillago ciliata* Cuv. dans la région de Nouméa. *Bull. Biol. Fr. Belg.*, 86:109-139.

Leis, J.M. and T. Trnski. 1989. *The Larvae of Indo-Pacific Shorefishes.* New South Wales University Press, Kensington. 372 p.

Lenanton, R.C.J. 1969a. Whiting fishery - Shark Bay. *Fishing Industry News Service*, 2(1):4-11. W. Aust. Dept. Fish. Wildl. Perth.

Lenanton, R.C.J. 1969b. Whiting research, Shark Bay tagging programme. *Fishing Industry News Service*, 2(2):5. W. Aust. Dept. Fish. Wildl. Perth.

Lenanton, R.C.J., A.J. Robertson and J.A. Hanson. 1982. Nearshore accumulations of detached macrophytes as nursery areas for fish. *Marine Ecol. (Prog. Ser.)*, 9(1):51-57.

Lin, S. 1933. A new genus and three new species of marine fish from Hainan Island. *Lingnan Sci. J.*, 12:93-96.

Lloyd, R.E. 1907. Notes on a collection of marketable fish from Akyab, with a description of a new species of *Lactarius*. *Rec. Indian Mus.*, 1:219-231.

Maclean, J.L. 1971. The food and feeding of winter whiting (*Sillago maculata* Quoy and Gaimard) in Moreton Bay. *Proc. Linn. Soc. N. S. W.*, 96:87-92.

Macleay, W. 1879. Descriptions of some new fishes from Port Jackson and King George's Sound. *Proc. Linn. Soc. N. S. W.*, 3:33-37.

Macleay, W. 1881. *Descriptive catalogue of Australian fishes.* F.W. White, Sydney. Vol. 1. 264 p., Vol. 2. 324 p.

Macleay, W. 1883. Contribution to a knowledge of the fishes of New Guinea - No. 2. *Proc. Linn. Soc. N. S. W.*, 7:351-366.

Macnae, W. and M. Kalk (eds.). 1969. *A natural history of Inhaca Island, Mozambique.* Witwatersrand Univ. Press, Johannesburg.

Marshall, T.C. 1964. *Fishes of the Great Barrier Reef and coastal waters of Queensland.* Angus and Robertson, Sydney. 566 p., 136 pls (72 colour).

Martin, C. and H.R. Montalban. 1935. Philippine Sillaginidae. *Philipp. J. Sci.*, 55:221-227.

Masuda, H., K. Amaoka, C. Araga, T. Uyeno and T. Yoshino (eds.). 1984. *The fishes of the Japanese Archipelago.* Tokai University Press, Tokyo. 437 p.

Masuda, H., C. Araga and T. Yoshino. 1975. *Coastal Fishes of southern Japan.* Tokai University Press, Tokyo. 384 p.

Maxwell, C.N. 1921. Malayan fishes. *J. Straits Brch. R. Asiat. Soc.*, 84:181-280, 72 pls.

McCoy, F. 1879-1890. *Prodromus of the zoology of Victoria.* 20 decades in 2 vols. Govt. Printer, Melbourne. 375 p., 200 pls.

McCulloch, A.R. 1911. Report on the fishes obtained by the F.I.S. "Endeavour" on the coasts of New South Wales, Victoria, South Australia and Tasmania. In: *Biological Results of the Fishing Experiments carried on by F.I.S., "Endeavour".* Vol. 1, p. 1-87, pls 1-16.

McCulloch, A.R. 1912. Notes on some Western Australian Fishes. *Rec. West. Aust. Mus.*, 1:78-97.

McCulloch, A.R. 1921. Checklist of the fish and fish-like animals of New South Wales. Part 2. *Aust. Zool.*, 2:24-68.

McCulloch, A.R. 1927. *The fish and fish-like animals of New South Wales.* Royal Zoological Society of New South Wales, Sydney. Third Edition. 104 p.

McKay, R.J. 1980. The fishes of the family Sillaginidae from India with a description of a new species. *J. Mar. Biol. Assoc. India,* 1976, 18(2):375-385.

McKay, R.J. 1983. *Sillago asiatica*, p. 613-614. In: Dutt, S. and Sujatha, K., On a new species of *Sillago* Cuvier, 1817 (Teleostei : Sillaginidae) from India. *Proc. Indian Natl. Sci. Acad.*, B48(5):611-614 (1982).

McKay, R.J. 1985. A revision of the fishes of the family Sillaginidae. *Mem. Queensland Mus.*, 23(1):1-73.

McKay, R.J. 1986. Sillaginidae, p. 615-616. In: Smith, M.M. and P.C. Heemstra (eds.): *Smiths' Sea Fishes.* J.L.B. Smith Institute of Ichthyology, Grahamstown, 1047 p., 144 pls.

McKay, R.J. and L.J. McCarthy. 1989. A revision of the sillaginid fishes of the Arabian Gulf with a description of *Sillago arabica* new species. *Mem. Queensland Mus.*, 27(2):551-553.

McKay, R.J., S. Dutt and K. Sujatha. 1985. *Sillago (Parasillago) indica*, p. 38-39. In: McKay, R.J., A revision of the fishes of the family Sillaginidae. *Mem. Queensland Mus.*, 23(1):1-73.

Menon, A.G.K. 1961. On a collection of fish from the Coromandel coast of India including Pondicherry and Karaikkal areas. *Rec. Indian Mus.*, 59:369-404.

Meyer, A.B. 1885. Catlogo de los peces recolectados en el archipelago de las Indias orientales durante los anos 1870 a 1873. *An. Soc. Esp. Hist. Nat.*, 14:5-49.

Misra, K.S. 1962. An aid to the identification of the common commercial fishes of India and Pakistan. *Rec. Indian Mus.*, 57:1-320.

Mookerjee, H.K., D.N. Ganguly and T.C. Mazumdar. 1946. On the food of estuarine fish of Bengal. *Sci. Cult.*, 11:564-565.

Mori, T. 1928. A catalogue of the fishes of Korea. *J. Pan-Pacif. Res. Instn.*, 3(3):3-8.

Morton, R.M. 1982. *Reproductive biology and tagging studies of summer whiting, Sillago ciliata at Bribie Island, Queensland.* M. Sc. Thesis Univ. Queensland.

Morton, R.M. 1985a. The reproductive biology of summer whiting, *Sillago ciliata* C. & V., in northern Moreton Bay, Queensland. *Aust. Zool.*, 21(6-7):491-502.

Morton, R.M. 1985b. The tagging of summer whiting, *Sillago ciliata* in northern Moreton Bay, Queensland. *Proc. R. Soc. Queensland*, 96:19-23.

Mouneime, N. 1977. Liste des poissons de la côte du Liban (Mediterranée orientale). *Cybium*, 3e Sér., 1:37-66.

Munro, I.S.R. 1945. Postlarval stages of Australian fishes, No. 1. *Mem. Queensland Mus.*, 12:136-153.

Munro, I.S.R. 1949. Revision of Australian silver breams *Mylio* and *Rhabdosargus*. *Mem. Queensland Mus.*, 12(4):182-223, pls 1-23, figs 1-5.

Munro, I.S.R. 1955. *The marine and freshwater fishes of Ceylon*. Dept. External Affairs, Canberra. 351 p., 56 pls.

Munro, I.S.R. 1958. The fishes of the New Guinea region. *Papua New Guin. Agric. J.*, 10:97-369.

Munro, I.S.R. 1967. *The fishes of New Guinea*. Dept. Agriculture Stock and Fisheries, Port Moresby. 651 p., 1-78 pls.

Nadkarni, V.B. 1963. Structure of the kidney of marine fishes in relation to their habitat, p. 157-170. In: *Recent advances in zoology in India*. Zool. Survey India, Dehli.

Nogusa, S. 1951. Chromosome studies in Pisces, II. On the chromosomes of *Sillago sihama* (Sillaginidae) and *Parasilurus asotus* (Siluridae). *Jap. J. Genet.*, 26:153-155.

Nogusa, S. 1960. A comparative study of the chromosomes in fishes with particular consideration on taxonomy and evolution. *Mem. Hyogo Univ. Agric.*, 3:1-62, pls 1-6.

Ogilby, J.D. 1886. *Catalogue of the fishes of New South Wales with their principal synonyms*. Govt. Printer, Sydney. 67 p.

Ogilby, J.D. 1893. *Edible Fishes and Crustaceans of New South Wales*. Govt. Printer, Sydney. 212 p., 51 pls.

Ogilby, J.D. 1910. On some new fishes from the Queensland coast. *Proc. R. Soc. Queensland*, 23:85-139. (Paper read before the Royal Society of Queensland on November 20, 1910 but was withheld from publication outside of authors copies).

Okada, Y. 1955. *Fishes of Japan. Illustrations and descriptions of fishes of Japan*. Maruzen Co. Ltd., Tokyo. 434 p., 391 figs.

Oozeki, Y. and R. Hirano. 1985. Effects of temperature changes on the development of the eggs of the Japanese whiting *Sillago japonica* Temminck and Schlegel. *Bull. Jap. Soc. Scient. Fish.*, 51(4):557-572.

Oozeki, Y., P.-P. Hwang and R. Hirano. 1992. Larval Development of the Japanese whiting, *Sillago japonica*. *Jap. J. Ichthyol.*,39(1):59-66.

Palekar, V.C. and D.V. Bal. 1955. Occurrence of *Sillago chondropus*, Blkr., in the seas of India. *Curr. Sci.*, 24:128.

Palekar, V.C. and D.V. Bal. 1959. Studies on the food and feeding habits of the Indian Whiting (*Sillago sihama* Forsskål) from Karwar waters. *J. Univ. Bombay* (NS), 27 B(5):1-18, 8 figs.

Palekar, V.C. and D.V. Bal. 1961. Studies on the maturation and spawning of the Indian whiting (*Sillago sihama* Forsskål) from Karwar waters. *Proc. Indian Acad. Sci.*, 54 B:76-93.

Paradice, W.E.J. and G.P. Whitley. 1927. Northern Territory Fishes. An annotated list of fishes collected from the waters of the Northern Territory of Australia during the cruises of H.M.A.S. "Geranium", 1923-25. *Mem. Queensland Mus.*, 9(1):76-106.

Parrott, A.W. 1959. *Sea anglers fishes of Australia*. Hodder and Stoughton, Melbourne. 208 p.

Pellegrin, J. 1905. Mission permanente française en Indo-Chine des poissons de la Baie d'Along (Tonkin). *Bull. Soc. Zool. Fr.*, 30:82-88.

Pellegrin, J. 1907. Liste des poissons recueillis à Madagascar par M.F. Geay. Description d'une espèce nouvelle. *Bull. Mus. Natl. Hist. Nat. Paris*, 1907, 3:201-206.

Pellegrin, J. 1914. Sur une collection de poissons de Madagascar. *Bull. Soc. Zool. Fr.*, 39:221-234.

Peters, W. 1865. Berichte über einige neue Säugethiere...Amphibien...und Fische... *Monatsber. Dtsch. Akad. Wiss. Berlin*, 1864:381-399.

Peters, W. 1877. Übersicht der während der von 1874 bis 1877 unter dem Commando des Herrn Capitän z.S. Freiherrn von Schleinitz ausgeführten Reise S.M.S. "Gazelle" gesammelten und von der kaiserlichen Admiralität der königlichen Akademie der Wissenschaften übersandten Fische. *Monatsber. dtsch. Akad. Wiss. Berlin*, 1876:831-854.

Playfair, R.L. 1867. The fishes of Seychelles. *Proc. Zool. Soc. London*, 1867:846-872.

Pohl, C.A. 1884. *Museum Godeffroy Catalog 9.* Friederichsen, Hamburg. 46 p.

Pollock, B.R. 1980. Surprises in Queensland angling study. *Aust. Fish.*, 39(4):17-19.

Pollock, B.R. and M.J. Williams. 1983. An assessment of the angling fishery for summer whiting, *Sillago ciliata* and *S. analis*, in Moreton Bay, Queensland from 1959 to 1980. *Proc. R. Soc. Queensland*, 94:85-90.

Quoy, J.R.C. and J.P. Gaimard. 1824-1825. Zoology. Poissons. In: L. de Freycinet, *Voyage autour du Monde .... exécuté sur les corvettes de S.M. "L'Uranie" et "La Physicienne", pendant les années 1817-1820.* Pillet Aîné, Paris. 712 p.

Quoy, J.R.C. and J.P. Gaimard. 1834. Poissons 3, p. 647-720, 20 pls. In: *Voyage de découvertes de "L'Astrolabe" exécute par ordre du Roi, pendant les années 1826-29; sous le commandement de M.J. Dumont d'Urville.* I. Tastu, Paris.

Radhakrishnan, N. 1954. Occurrence of growth rings on the otoliths of the Indian whiting, *Sillago sihama* (Forsskål). *Curr. Sci.*, 23:196-197.

Radhakrishnan, N. 1957. A contribution to the biology of Indian sand whiting *Sillago sihama* (Forsskål). *Indian J. Fish.*, 4:254-283.

Ramamurthy, S. and M.H. Dhulkhed. 1977. Availability of seeds of *Sillago sihama* for farming along South Kanara coast. *Indian J. Fish.*, 22(2):283-284.

Reeves, C.D. 1927. A catalogue of the fishes of northeastern China and Korea. *J. Pan-Pacif. Res. Instn.*, 2(3):3-16.

Regan, C.T. 1908. A collection of fishes from the coasts of Natal, Zululand and Cape Colony. *Ann. Natal Mus.*, 1(3):241-255.

Regan, C.T. 1913. The classification of the Percoid Fishes. *Ann. Mag. Nat. Hist.*, (8)12:111-145.

Richardson, J. 1842. Contributions to the ichthyology of Australia. *Ann. Mag. Nat. Hist.*, (1)9:120-131.

Richardson, J. 1843. Icones Piscium or Plates of Rare Fishes. R. & J. Taylor, London. p. 1-8, pls 1-5.

Richardson, J. 1846. Report on the ichthyology of the seas of China and Japan. *Rep. Br. Ass. Advmt. Sci., 15th meet.*, 1845:187-320.

Robertson, A.I. 1977. Ecology of juvenile King George whiting *Sillaginodes punctatus* (Cuvier & Valenciennes) (Pisces: Perciformes) in Western Port, Victoria. *Aust. J. Mar. Freshwat. Res.*, 28(1):35-43.

Roughley, T.C. 1951. *Fish and fisheries of Australia.* Angus and Robertson, Sydney. 344 p., 80 pls (60 colour).

Rüppell, E. 1828-1830. *Atlas zu der Reise im nördlichen Afrika von Eduard Rüppell, Zoologie 4, Fische des Rothen Meers.* Heinrich Ludwig Börner, Frankfurt am Main. 141 p.

Rüppell, E. 1835-1838. *Neue Wirbelthiere zu der Fauna von Abyssinien gehörig.* 2 vols. Siegmund Schmerber, Frankfurt am Main.

Rutter, C. 1897. A collection of fishes obtained in Swatow, China by Miss Adele M. Fielde. *Proc. Acad. Nat. Sci. Philad.*, 1897:56-90.

Sainsbury, K.J., P.J. Kailola and G.G. Leyland. 1985. *Continental Shelf Fishes of Northern and North-Western Australia*. CSIRO, Canberra, Commonwealth of Australia. 375 p.

Sandars, D.F. 1945. Five new microcotylids from fish from Western Australian waters. *J. Proc. R. Soc. West. Aust.*, 29:107-135.

Sano, M. and K. Mochizuki. 1984. A revision of the Japanese sillaginid fishes. *Jap. J. Ichthol.*, 31(2):136-149.

Sauvage, H.E. 1881. Sur une collection de poissons de Swatow. *Bull. Soc. philomath. Paris*, (7) 5:104-108.

Schmeltz, J.D. 1866. Topographische und zoologische Notizen. *Cat. Mus. Godeffroy*,. 3:1-142.

Schmeltz, J.D. 1869. Topographische und zoologische Notizen. *Cat. Mus. Godeffroy*, 4:1-142.

Schmeltz, J.D. 1879. Topographische und zoologische Notizen. *Cat. Mus. Godeffroy*, 7:1-100.

Schwarzhans, W.W. 1984. *Fish otoliths from the New Zealand Tertiary*. Report NZGS 113. New Zealand Geological Survey. 269 p.

Scott, J.S. 1959. *An introduction to the sea fishes of Malaya*. Govt. Printer, Kuala Lumpur. 180 p.

Scott, T.D. 1962. *The marine and freshwater fishes of South Australia*. Govt. Printer, Adelaide. 388 p.

Scott, T.D., C.J.M. Glover and R.V. Southcott. 1974. *The marine and freshwater fishes of South Australia*. Govt. Printer, Adelaide. 392 p.

Seale, A. 1910. Fishes of Borneo with descriptions of four new species. *Philipp. J. Sci.*, 5:263-288.

Seale, A. 1914. Fishes of Hong Kong. *Philipp. J. Sci.*, 9:59-79.

Shao, K.T. and K.H. Chang. 1978. A Revision of the sandborers (genus *Sillago*) of Taiwan. *Bull. Inst. Zool. Acad. Sin.*, 17(1):1-11.

Shao, K.T. and K.H. Chang. 1979. Systematic studies of sandborers (genus *Sillago*) from the waters around Taiwan. *Proc. Inst. Symp. Mar. Biogeogr. Evol. Hemisphere*, Govt. Print, Wellington.

Shao, K.T., S.-C. Shen and L.-W. Chen. 1986. A newly recorded sandborer, *Sillago* (*Sillaginopodys*) *chondropus* Bleeker, with a synopsis of the fishes of the family Sillaginidae of Taiwan. *Bull. Inst. Zool. Acad. Sin.*, 25(2):141-150.

Smith, C.L. and R.M. Bailey. 1961. Evolution of the dorsal-fin supports of percoid fishes. *Pap. Mich. Acad. Sci.*, 46:345-363.

Smith, C.L. and R.M. Bailey. 1962. The subocular shelf of fishes. *J. Morphol.*, 110:1-18.

Smith, H.M. and T.E.B. Pope. 1906. List of fishes collected in Japan in 1903, with descriptions of new genera and species. *Proc. U. S. Natl. Mus.*, 31:459-499.

Smith, J.L.B. 1949. *The sea fishes of Southern Africa*. Central News Agency, Ltd, South Africa. 550 p., 103 pls, 1232 figs.

Smith, J.L.B. 1955. The fishes of Aldabra. Part 2. *Ann. Mag. Nat. Hist.*, (12) 8:689-697.

Smith, J.L.B. and M.M. Smith. 1963. *The fishes of the Seychelles*. Dept. Ichthyology, Rhodes Univ., Grahamstown. 215 p., 98 pls.

Srivastava, P.N. 1955. Morphology and histology of the air-bladder of certain sciaenoid fishes with the description of a new type of ear-air bladder connection. *Proc. Natl. Inst. Sci. India*, 21 B:74-78.

Stanbury, P.J. 1969. Type specimens in the Macleay Museum, University of Sydney. *Proc. Linn. Soc. N. S. W.*, 93:203-210.

Starks, E. 1926. Bones of the ethmoid region of the fish skull. *Stanf. Univ. Publs. Biol. Sci.*, 4:139-338.

Stead, D.G. 1906a. Exhibition of series of New South Wales whitings, with notes. *Proc. Linn. Soc. N. S. W.*, 30:574-576.

Stead, D.G. 1906b. *Fishes of Australia: A popular and systematic guide to the study of the wealth within our waters*. William Brooks & Co. Ltd., Sydney. 278 p., 10 pls.

Stead, D.G. 1908a. *New fishes from New South Wales (no. 1).* Govt. Printer, Sydney. 12 p.

Stead, D.G. 1908b. *The edible fishes of New South Wales: Their present importance and their potentialities.* Govt. Printer, Sydney. 123 p., 81 pls.

Steindachner, F. 1866. Zur Fischfauna von Port Jackson in Australien. *Sitzungsber. Österr. Akad. Wiss. Wien,* 53:424-481.

Steindachner, F. 1870. Bericht über eine Sammlung von Fischen aus Singapore. *Sitzungsber. Österr. Akad. Wiss. Wien,* 60:557-571.

Steindachner, F. 1893. Ichthyologische Beiträge. 16. *Sitzungsber. Österr. Akad. Wiss. Wien,* 120:215-243.

Steindachner, F. and L. Döderlein. 1885. Beiträge zur Kenntniss der Fische Japans III. *Denkschr. Österr. Akad. Wiss. Wien,* 49:171-212.

Stinton, F.C. 1953. Fish otoliths from the Pliocene of South Australia. *Trans. R. Soc. S. Aust.,* 76:66-69.

Stinton, F.C. 1958. Fish otoliths from the Teritary strata of Victoria, Australia. *Proc. R. Soc. Victoria,* 70:81-93.

Stokes, J.L. 1846. *Discoveries in Australia ... during the voyage of H.M.S. "Beagle" in the years 1837-1843.* Vol. 2. T. & W. Boone, London. 543 p.

Sujatha, K. 1988. Spatial distribution of fishes of the family Sillaginidae in estuarine waters. *J. Mar. Biol. Assoc. India,* 29(1-2):367-368.

Sujatha, K. and S. Dutt. 1985. Shape of swimbladder in family Sillaginidae (Pisces) and its taxonomic value. *Mahasagar,* 18(3):429-431.

Suvatti, C. 1950. Fishes, p. 180-446. In: *Fauna of Thailand.* Dept. Fisheries, Bangkok. 1100 p.

Swainson, W. 1838-1839. *On the natural history and classification of fishes, amphibians, and reptiles or monocardian animals.* Longman and others, London. 2 vols.

Takahashi, Y. 1962. Study for the identification of species based on the vertebral column of Teleostei in the Inland Sea and its adjacent waters. In: *Studies on identification of species and restoration of body-size based on vertebral column of Teleostei.* Reprinted from *Bull. Naikai Regional Fisheries Res. Lab.,* No. 16. (In Japanese).

Tanaka, S. 1913. *Figures and descriptions of the fishes of Japan, including Riukiu Islands, Bonin Islands, Formosa, Kurile Islands, Korea, and Southern Sahkalin.* Maruzen Co.Ltd., Tokyo. 14:231-246, pls 66-70.

Taylor, W.R. 1964. Fishes of Arnhem Land. In: R.L. Specht (ed.), *Records of the American - Australian scientific expedition to Arnhem Land. Vol. 4. Zoology.* Melbourne University Press, Melbourne. p. 45-307, pls.

Temminck, C.J. and H. Schlegel. 1842-1850. Pisces, 324 p., 144 pls. In: Ph. Fr. von Siebold, *Fauna Japonica.* Lugdumi Batavorum, Batavia.

Tension-Woods, J.E. 1882. *Fish and fisheries of New South Wales.* Govt.Printer, Sydney. 213 p., 45 pls.

Thiollière, V.J. 1857. Ichthyologie, p. 139-222. In: P. Montrouzier, *Essai sur la faune de l'île de Woodlark ou Moiou.* Dumoulin, Lyon. 226 p.

Tomiyama, I. and T. Abe. 1958. *Figures and descriptions of the fishes of Japan (A continuation of Dr Shigeho Tanaka's work).* 57:1171-1194, pls 229-231. Kazama Shobo, Tokyo.

Tosh, J.R. 1902. On the common whiting of Moreton Bay (*Sillago bassensis*). *Proc. R. Soc. Queensland,* 17:175-184, pls 8-14.

Tripathi, Y.R. 1952. Studies on parasites of Indian fishes, I, Protozoa Myxosporidia together with a check list of parasitic protozoa described from Indian fishes. *Rec. Indian Mus.,* 50:63-88.

Tsukashima, Y., N. Yoshida, C. Kitajima, S. Matsumura and C.L. Blesch. 1983. Mass rearing of the fry of Japanese whiting *Sillago japonica* initially fed with smaller size rotifer, *Brachionus plicatilis* filtered with a fine mesh net. *Aquiculture,* 30(4):202-210.

Ueno, M. and S. Fujita. 1954. On the development of the egg of *Sillago sihama* (Forsskål). *Jap. J. Ichthyol.*, 3:118-120, 1 fig. (In Japanese with English summary).

Umali, A.F. 1934. The fishery industries of southwestern Samar. *Philipp. J. Sci.*, 54:365-389.

Valenciennes, A. 1839. Poissons. In: *Cuvier's Le règne Animal ... (Disciples' ed.)*. Vol. 8. Paris, 120 p.

Villadolid, D.V. 1937. The fisheries of Lake Taal, Pansipit River, and Balayan Bay, Batanges Province, Luzon. *Philipp. J. Sci.*, 63:191-225.

Vinciguerra, D. 1926. Catalogo dei pesci raccolti a Borneo dai Sigg. Marchese G. Doria e Dott. O. Beccari negli anni 1865-67. *Ann. Mus. Civ. Stor. Nat. Giacomo Doria*, (3)10:532-628.

Waite, E.R. 1898. Report on the fishes. *Sea Fisheries Rept. H.M.C.S. "Thetis"*, 23-62.

Waite, E.R. 1899. Scientific results of the trawling expedition of H.M.C.S. "Thetis". Introduction and fishes. *Mem. Aust. Mus.*, 4:1-132.

Waite, E.R. 1901. Additions to the fish fauna of Lord Howe Island, No. 2. *Rec. Aust. Mus.*, 4:36-47.

Waite, E.R. 1902. Notes on fishes from Western Australia, No. 2. *Rec. Aust. Mus.*, 4:179-194.

Waite, E.R. 1904. A synopsis of the fishes of New South Wales. *Mem. N. S. W. Nat. Club.*, 2:1-59.

Waite, E.R. 1921. Catalogue of the fishes of South Australia. *Rec. S. Aust. Mus.*, 2:1-208.

Waite, E.R. 1923. *The fishes of South Australia*. Govt. Printer, Adelaide. 243 p.

Waite, E.R. 1928. Checklist of the marine fishes of South Australia. *J. Pan-Pacif. Res. Instn.*, 3(1):3-10.

Weber, M. 1913. Die Fische der Siboga-Expedition. *Siboga-Expeditie*, 57:1-710.

Weber, M. and de L.F. Beaufort. 1931. *The fishes of the Indo-Australian Archipelago*. Vol. 6. E.J. Brill, Leiden. 448 p.

Weng, H.T. 1983. Identification, habitats and seasonal occurrence of juvenile whiting (Sillaginidae) in Moreton Bay, Queensland. *J. Fish Biol.*, 23:195-200.

Weng, H.T. 1986. Spatial and temporal distribution of whiting (Sillaginidae) in Moreton Bay, Queensland. *J. Fish Biol.*, 29:755-764.

Whitehead, P.J.P. and K.A. Joysey. 1967. The Vachell collection of Chinese fishes in Cambridge. *Bull. Br. Mus. (Nat. Hist.) (Zool.)*, 15:123-165.

Whitley, G.P. 1928. A checklist of the fishes of the Santa Cruz archipelago, Melanesia. *J. Pan-Pacif. Res. Instn.*, 3(1):12.

Whitley, G.P. 1932a. Studies on ichthyology, no. 6. *Rec. Aust. Mus.*, 18:321-348.

Whitley, G.P. 1932b. Fishes. *Sci. Repts. Great Barrier Reef Exped.* 4(9):267-316.

Whitley, G.P. 1943. Ichthyological notes and illustrations (Part 2). *Aust. Zool.*, 10:167-187.

Whitley, G.P. 1944. New sharks and fishes from Western Australia. *Aust. Zool.*, 10:252-273.

Whitley, G.P. 1948. A list of the fishes of Western Australia. *Fish. Bull. West. Aust.*, 2:1-35.

Whitley, G.P. 1951. New fish names and records. *Proc. R. Zool. Soc. N. S. W.*, 1949-1950:61-68.

Whitley, G.P. 1954. New locality records for some Australian fishes. *Proc. R. Zool. Soc. N. S. W.*, 1952-1953:23-30.

Whitley, G.P. 1955. The largest (and the smallest) Australasian fishes. *Aust. Mus. Mag.*, 11(10):329-332.

Whitley, G.P. 1962. *Marine fishes of Australia* 1. Jacaranda Press, Brisbane. 142 p.

Whitley, G.P. 1964. A survey of Australian ichthyology. *Proc. Linn. Soc. N. S. W.*, 89:11-127.

Wongratana, T. 1977. *Sillago intermedius*, a new species of sand whiting from the Gulf of Thailand (Pisces: Sillaginidae). *Nat. Bull. Siam. Soc.*, 26:257-252.

Woodland, D.J. and R. Slack-Smith. 1963. Fishes of Heron Island, Capricorn Group, Great Barrier Reef. *Pap. Dep. Zool. Univ. Queensland*, 2:15-70.

Yu, T.-C. and Y.-C. Chang. 1986. On the breeding of *Sillago sihama*. *Bull. Taiwan Fish. Res. Inst.*, No. 40:127-130.

Yu, T.-C. and Y.-C. Chang. 1987. Studies on the culture of silver whiting *Sillago sihama*. *Bull. Taiwan Fish. Res. Inst.*, 42:227-229.

Yu, T.-C. and T.-Y. Tung. 1983. Studies on growth and artificial breeding of the common whiting *Sillago japonica*. *Bull. Taiwan Fish. Res. Inst.*, 35:143-148.

Yu, T.-C. and T.-Y. Tung. 1985. Studies on culture of *Sillago japonica*. *Bull. Taiwan Fish. Res. Inst.*, 38:115-121.

6. INDEX OF SCIENTIFIC AND VERNACULAR NAMES

EXPLANATION OF THE SYSTEM

Type faces used:

Italics (bold)	:	Valid scientific names (double entry by genera and species)
Italics	:	Synonyms (double entry by genera and species)
Roman (bold)	:	International (FAO) species names
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